JAN 17 1918

NOTICE TO READER.
When you finish reading this magazine place a 1-cent stamp on this notice, hand same to any postal employee, and it will be placed in the hands of our soldiers or sailors at the front.
NO WRAPPING—NO ADDRESS.
A. S. BURLESON,
Postmaster General.

TELEPHONE ENGINEER

Volume XIX *CHICAGO, JANUARY, 1918* *Number 1*

THEORIES

There was a time when men **believed** the world to be flat.
Workmen formerly **considered** machines their enemies.
It used to be **argued** that the Automatic Telephone is not economical to operate.
"Subscribers do not like the Automatic service" is a statement of **opinion.**
"Automatic equipment is hard to maintain" is a **fear** of those who have not tried it.

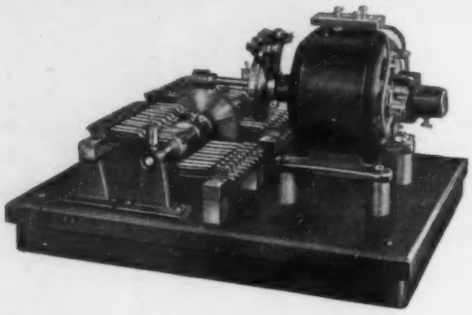
FACTS

Men now **know** that the world is a sphere.
Machines **actually** bring prosperity to both workers and capitalists.
The records of companies operating Automatic **demonstrate** its economy.
"Subscribers prefer Automatic service" is the **real** condition.
"Easy to maintain" is the **verdict** of those who are maintaining Automatic.

When a Theory Encounters a Fact the Fact Survives, the Theory Falls

Companies which TRY the Automatic
Invariably EXTEND its use.

AUTOMATIC ELECTRIC CO.
CHICAGO



Holtzer-Cabot Interrupters

To Produce *Howler, Busy - Back, Don't Answer, Automatic Ringing,* and *Recall Flashing* in Central Energy Exchanges

THE HOWLER consists of a High Speed Ring divided into sectors.

THE BUSY-BACK AND DON'T ANSWER consists of two Contact Springs, which make and break at given intervals.

There is a set of brushes lying upon the high speed ring, through which is passed direct current, which is interrupted as it flows out into the circuits. For the Howler circuit, the interrupted current is taken direct from this high speed ring.

For the Busy Back and Don't Answer, the high speed interrupted current is again subdivided through slow speed contact springs, producing signals which are employed in various ways.

THE AUTOMATIC RINGING ATTACHMENT shown with each set, consists of a framework upon which are mounted springs, which are operated by bumper wheels, these in turn being motor-driven.

In a busy exchange, **the operator is able, by using the Automatic Ringing Attachment in signalling subscribers, to handle a great many more calls than without it.**

THE RECALL FLASHER consists of a group of springs actuated by a bumper wheel, which continually flashes the lamp at the switchboard when it is necessary to recall the operator after the cord circuit has been established.

The subscriber **only moves the receiver hook once to light this lamp,**—it isn't necessary for her to jerk the receiver up and down to attract the operator.

We Also Make a Special Interrupter

consisting of a *double collector, so arranged as to produce two tones;* one equivalent to about 44,000 interruptions per minute, and the other to 9,900 interruptions per minute.

The Holtzer-Cabot Electric Co.

6161-5 So. State St., Chicago, Ill.

Every Man Is Naturally a Keen Critic of Tools

He may recognize the fact that he knows nothing about hats and shoes—admit that "he is a babe in arms" in judging clothes quality—but when it comes to tools you've got to *"show him."*

OSHKOSH quality—demonstrated in dependable day-in-day-out *service*—is showing thousands of tool users—to the benefit of every OSHKOSH Jobber.

Oshkosh jobbers cover the country—ask us the name of the nearest

OSHKOSH MFG. CO.

Oshkosh Wis.

TRADE OSHKOSH MARK

TOOLS

Telephone Wire

SATISFACTORY SERVICE DEPENDS
LARGELY UPON
SATISFACTORY WIRING

SIMPLEX TELEPHONE WIRE IS APPROVED
BY TELEPHONE ENGINEERS

Samples free

SIMPLEX WIRE & CABLE Co

MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

PAUL H. WOODRUFF, Editor
Monadnock Building, CHICAGO

New York Office, 1022 Longacre Building
Forty-second St. and Broadway
Telephone Bryant 7030

This publication is free and independent of all business or house connections or control. No manufacturer or supply dealer, or their stockholders or representatives, have any financial interest in Telephone Engineer or any voice in its management or policy.

Entered at Chicago Post Office as Second Class Mail Matter

Telephone Engineer

WITH WHICH IS CONSOLIDATED
The Western Telephone Journal
ESTABLISHED 1902

PUBLISHED MONTHLY BY
ELECTRICITY MAGAZINE CORPORATION
MONADNOCK BUILDING, CHICAGO, ILL.
Telephone: Harrison 3014—All Departments

NOTICE TO ADVERTISERS

Changes of advertising copy should reach the office of publication not less than ten days in advance of date of issue. Regular date of issue, first day of each month. New advertisements will be accepted up to within five days of date of issue, but proof of such advertisements cannot be shown in advance of publication.

SUBSCRIPTION PRICE
Per Year $2.00

Canada	$2.50
Foreign	3.00
Single copy	.20

FOR SALE AT ALL NEWS STANDS

NOTICE TO SUBSCRIBERS

REMITTANCES — Remittances should be made by check, New York draft or money order, in favor of TELEPHONE ENGINEER. Foreign subscriptions may be remitted direct by International Postal Money Order.

CHANGE OF ADDRESS—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

If Your News Dealer Will Not Supply You—Please Notify Us

VOL. XIX CHICAGO, JANUARY, 1918 NO. 1

The Question of Ownership

WHILE the maelstrom of war necessity whirls at our feet, drawing first one individual or one industry and then another into its centrifugal activity, there is constantly going on a tense but silent struggle between private and public ownership of the utilities. It is a battle not of men but of conditions; for those most directly concerned in it are hardly aware of it.

The utility operators became accustomed before the war to state and federal restriction. When the national need became evident, they offered all they had left of business freedom to the government. The public utilities at this moment (particularly the railroads and the telephones) are more nearly government departments than ever before.

We are accustomed to speak of commission "control"; and commissions are a part of government, either state or federal. Yet we see now, as we view the railroad situation, that our use of the term control has been vague and meaningless. For though we hear that the government has "taken over" the railroads of the country, that is not literally true. What the railroads have entered into is simply an indefinite extension of the powers of that same control. The government approaches no nearer in fact to owning the railroads today than it did a month or a year ago. But it is actually operating them with practically all the privileges of ownership.

Of course the adventure of the railroads is no criterion for what may happen to other utilities. Railroad efficiency was handicapped by a long history of mismanagement. Railroad capital was already on strike, making new financing almost impossible. Railroad labor was becoming extraordinarily troublesome. The railroads were illogically but nevertheless forcibly blamed for congestion at their terminals—responsibility for which really lies in the failure of shippers to move their goods. The ability of the government to eliminate competitive waste without violating any statutes, and to refinance with absolute security to investors, affords all the reason needed to justify absolute government control.

The telephone lines are involved in none of the disadvantageous conditions afflicting the railroads. Their skirts are clear; their hands are clean. Nevertheless, we need not voice the thought that flashed into every telephone man's mind that December day when the Official Bulletin announced that the government would run the railroads as its own.

The railroads tried their best to satisfy the government's war needs. Apparently they failed. The telephones have been trying their best to satisfy those needs ever since April 6, 1917—and before. Apparently they have succeeded. So there is no immediate need to compare railroad conditions with telephone conditions. Indeed, they will not compare.

Nevertheless, the coterie of official and unofficial enthusiasts who cry continually for federalization of wires are augmented and heartened by all the extraordinary conditions of the hour. Government resolution in assuming railroad operation, government success in bringing order out of railroad confusion, all funish powder for the guns of the federal wire propagandists. The postmaster-general and his legislative backers are given new power, new rhetoric, new friends.

There is no denying that the idea of federal telephony is given a more material aspect.

From now on there will be more designing statesmen and more unthinking laymen to espouse its cause than ever before.

A flamboyant trade unionism, seizing (as is its custom) the opportunity presented by the patriotic preoccupation of its patron, has aligned itself upon the side of utility federalization—hopeful that its influence might carry the weight of a potent threat. It has thrown its voice for public ownership, ignorant perhaps of the fact that in war time a wise government operating its own utilities, might conscript its workers at conscripts' pay.

The peace of nations may not make peace for the question of public ownership. The success of government control for war will raise a horde of mushroom advocates for permanent state operation.

Logical thinkers will see in the demonstration of utility efficiency for war work a decision for private ownership in peace work for all time. But utility operators must arm themselves against illogical thinkers and those who exert their influence without adequate thought, or with ulterior motives concealed behind favoring circumstances. Of these are the councils of government often composed.

Honest business, sincerely operated, has nothing to fear from the application of searching logic. It has but to face the fact that logic does not rule the world.

Rate Raising Is the Order of the Day

TELEPHONE men are inclined to pass over the subject of street car fare increase without particular interest. That there is little in the street car situation that is pertinent to the telephone business is true. But what little there is has at least one strongly significant point, explainable in one sentence.

The five cent street car fare is so solidly established as a tradition, a custom, an institution, that no telephone company has any rate-changing difficulty comparable to it.

Yet a list published by "Public Service" shows that some eighty-odd street car fare increases have been granted in twenty-three states and Canada by utility commissions and many more are pending.

The street car company's plea for increased rates is made infinitely more difficult than the telephone company's by circumstance and psychology and everything that tends to fix a figure in the popular mind. Yet the street car companies have sought and obtained their raises because they found that they HAD TO. The telephone companies have not yet realized the urgent necessity of their case.

A list printed on another page shows that out of 462 requests for higher rates made by public utilities to state commissions in 1917, nearly 87 per cent, or 401, were granted by the commissions. The almost total absence of telephone companies (except in Wisconsin) from this list is a sermon in itself on the comparative tardiness or bashfulness of telephone men in claiming their right to live.

A study of the section "Public Utility Commission News" in TELEPHONE ENGINEER for the last few months shows that the majority of requests for rate increases have been granted. What the commission reports do not show is that the public has universally met the increased rates, if with a protest, at least without reducing its patronage. Those who are afraid of protests, of course, deserve no increase.

The Bell people are displaying little hesitancy in claiming higher rates, and are getting them. It is high time for the Independent operators to move in the same direction.

Copper

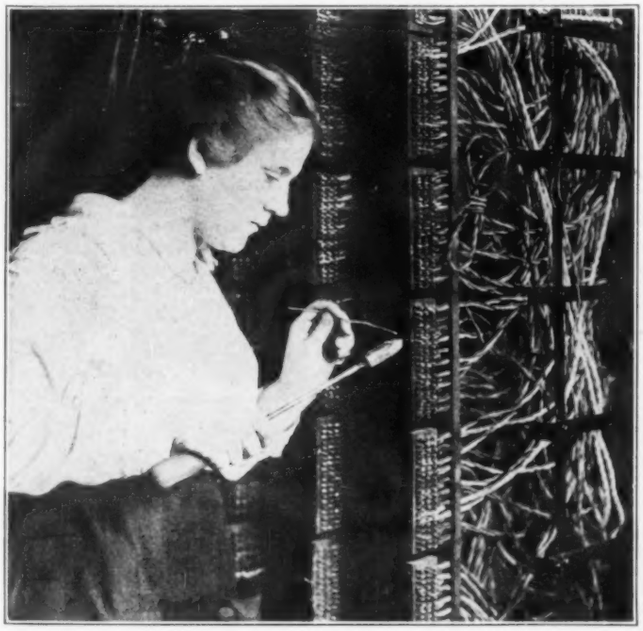
THE Treasury Department announces with apparent satisfaction that the export of copper in nine months of 1917 totalled 675,275,340 pounds, as against 458,316,552 pounds in the equivalent period of 1916—an increase of over 47 per cent. The department appeals to the copper miner, in his prosperity, to lend his money to the government, but neglects to state whether the production is equal to the increase. But the figures, added to the new military demands of the United States for copper, give sufficient reason for the vigilance and activity of the telephone priorities committee. Copper is necessary to the telephone business; but that fact will not make it avialable without continuous and aggressive application.

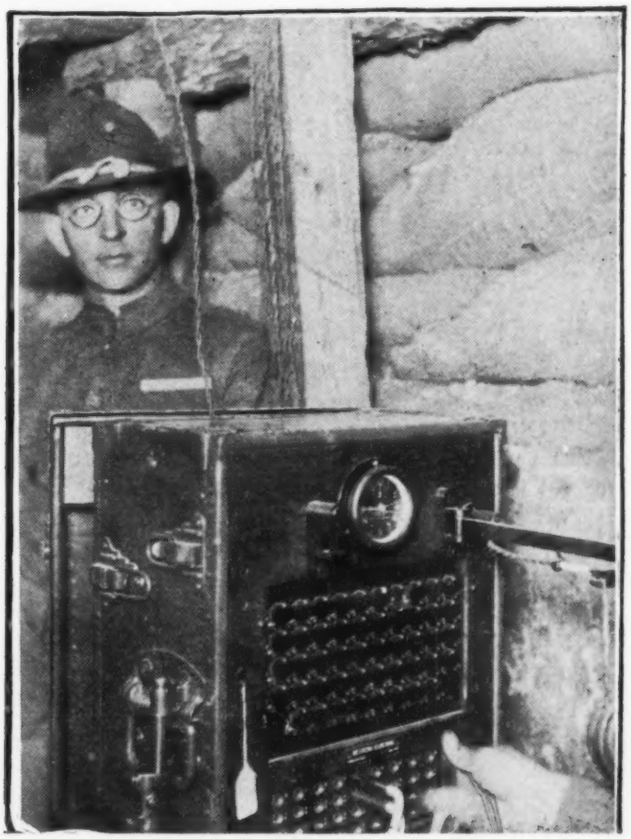
✓ 650.5 T32
v. 19

Above is shown a regimental dugout trench system used at Fort Sheridan Reserve Officers' Training Camp; Captain R. G. Peck, Captain George Bertrand, French Army, assistant to Senior Instructor and Lieutenant Colonel Cromwell Stacy, Senior Instructor.

To the right is the switchboard of trench system of telephone communication in dugout. Both are presented here by courtesy of the "Fort Sheridan Reveille," E. B. Lockwood, managing editor.

Below is a picture of Miss Mason, "Plant Man" of the Southern Bell System, mentioned in a story entitled "Women Succeed as Telephone Men" in the "Southern Telephone News."





Texas President Demands Raise

During the telephone investigation in Waco, Texas, J. B. Earle, president of the Texas Telephone Company, told the commissioners that he was to ask for a raise in rates, and if his request was not granted he would put them on anyway. He also said that if the people of Waco did not pay the charges he asked he would move to some other town. These remarks came in the process of the investigation. Mr. Earle, representing the public service corporation, endeavored to show that the abnormal conditions warranted an increase in rates or poor service.

C. W. McKennon was the first witness, and he told of the poor service he was receiving, giving about the same complaints as others.

Mr. Earle objected to Mr. Maxwell's asking the witness leading questions, saying it was not fair. After Mr. Maxwell was through with the witness, Mr. Earle began asking him questions, particularly with regard to the increase in his business and the increase in his prices. He asked him if he was not forced to raise his price on certain of his articles, and if the abnormal conditions did not force him to pay more for help, and if help was not hard to get, and if he found it harder to compete with conditions now than formerly. He replied that he did.

Then Mr. Maxwell asked him if the city provided him with protection in his business, whether or not he was guaranteed a certain amount of money for his products, and if he was given a franchise to conduct business, and if his prices were regulated by the city. He replied that his condition was different from that of a public service corporation and that he was not protected in his business, and he could close his doors if he wanted to, raise his prices as high as he wanted to, and that he could go bankrupt without any concern of anybody. The purpose of Mr. Maxwell's questions of this nature was in opposition to Mr. Earle when he tried to show that the condition of the telephone company in regard to increase in rates was similar to private enterprises.

A number of other witnesses were brought up, and they testified as to the service, some saying it was poor, while a few said it was good.

In his testimony about the service, Tom Wolfe related an amusing incident relative to the long distance service. He stated that he does a great part of his business over the telephone and telegraph. Mr. Wolfe said he has considerable trouble with the long distance service, and that he was in Fort Worth at one time, and had need to talk to his office here. He put in a call, waited about two hours and tried again. He says he then asked the operator why he could not get his own office at Waco, and was told the call would be through soon. He waited about two hours that night, and finally went to bed.

Mr. Wolfe stated that he arose the next morning, took the train to Waco and arrived here in the course of time. He said he went to his store, and was just opening the door when his phone was ringing. On answering the phone, Mr. Wolfe stated the operator announced that Mr. Wolfe at Fort Worth was calling his office. He politely informed the operator that this was Mr. Wolfe at Waco in his own store.

Don't allow yourself to get in the habit of thinking everyone is crooked but yourself.

A. T. & T. Reducing Debt

The American Telephone & Telegraph Company has purchased in the open market slightly more than $30,000,000 of its own and associate companies' notes. At one time last year $50,000,000 of these notes were outstanding. They mature Feb. 1, 1918, and carry interest at 4½ per cent a year. When issued in January, 1916, the notes consisted of $40,000,000 of American Telephone & Telegraph obligations and $10,000,000 of associate companies' issues. The company at the time arranged so that it could substitute $20,000,000 of associate companies' notes for a like amount of American Telephone & Telegraph notes. This substitution was made to the extent of $18,390,000. At the end of last year there were, therefore, $21,610,000 of American Telephone & Telegraph notes and $28,390,000 of associate companies' notes in the hands of the public. Purchasing of the notes began as early as last December, and up to date the total bought is $16,390,000 of associate companies' notes and $14,600,000 of the big company. Some of the notes were obtained at a slight premium and others at a discount. Only $7,000,000 of the American Telephone & Telegraph notes and $12,000,000 of the associate companies' notes are in the hands of the public. These, it is announced, will be retired promptly on maturity.

American Telephone and Telegraph stock dropped below par December 15 for the first time since 1907. It sold at 99½, but rallied to 100¼ at the close. The stock, which pays 8 per cent dividends, sold as high as 128½ early this year and in 1916 at 134½. The highest price it ever sold was 186. Agitation for public ownership of public utilities has perhaps been a factor in depressing the stock.

Both the American Telephone & Telegraph Company and the Western Union Telegraph Company show constant increases in gross business and operating income, and all indications are that these increases will continue. In October Western Union's operating income increased $456,474 and in ten months of this year $1,561,196. In the case of the American Telephone & Telegraph Company the increases were $37,435 and $589,033, respectively.

Girls Needed in France

A unit of 150 telephone operators, able to speak both French and English, for immediate service in France will be formed under the direction of the Army Signal Corps.

The operators, enlisted for the duration of the war, will be given the allowances of quarters and rations accorded many nurses in addition to their pay and also will wear the same uniform.

In seeking recruits for the new service the announcement of the chief signal officer says:

"Young ladies physically fit with command of the French and English language, desirous of obtaining these positions should apply by mail to Room 826 Mills Building annex, Washington."

Keystone Returns

Operating expenses of the Keystone Telephone Company having increased $9,082 in November, net earnings for the month fell $168. Gross receipts increased $8,915. For the eleven months of the calendar year the same account has risen $106,437 over the same time in 1916, while net earnings were raised $17,868.

Captain Vivian Is Off To War

Patriotic Association Secretary-Treasurer, Armed with Leave of Absence, Puts Office in Charge of Assistant

W. S. VIVIAN, commissioned a captain in the Signal Corps, is on his way to the European battle front to help straighten out the traffic complications of the astounding system of communications built up by the necessities of the greatest war. His departure from the Independent telephone center was almost dramatic in its suddenness. Only a few days elapsed from the hour he decided to apply for a commission until he closed his desk December 18 for an indefinite period.

Since every Independent telephone man—and woman—counts Mr. Vivian as a friend, a brief account of his career will not be out of place here.

In May, 1889, W. S. Vivian entered the employment of the Michigan Bell Telephone Company, where for several months he worked assembling instruments and as stock clerk, afterwards being made storekeeper for the western division which formed at that time. He continued in that position until July, 1901, the following year being spent in the employment of the American Express Company.

Captain W. S. Vivian, U. S. Signal Corps.

In August, 1902, he left the American Express Company and entered the employment of the Citizens Telephone Company, spending several weeks in its shop; in October of that year being sent to Lansing, Michigan, as traffic manager of that exchange.

In June, 1904, he was appointed manager of the Michigan Independent Telephone Traffic Association, which was organized at that time in Grand Rapids..

In 1907 he was elected secretary of the Michigan Independent Telephone Association, and occupied that position in addition to his work as manager and secretary of the Michigan Telephone Traffic Association.

On October 26, 1909, the first operators' school was held at Alma, Michigan, then the headquarters of the United Telephone Company. There were eighty operators of some fifty exchanges in attendance at this meeting. So far as we have record, this was the first operators' school ever held where so many operators were brought together from so large a number of offices.

In January, 1910, the Michigan Independent Telephone Traffic Association was reorganized and incorporated into the Michigan Independent Telephone & Traffic Association, Vivian being made secretary-treasurer.

On June 1, 1912, the first comprehensive set of Long Distance Operating Instructions for the Independent telephone operators was published. These consisted of three little booklets, one for the manager, one for the chief operator and one for the Association. These rules were followed the next year by what afterwards became known as the "Red Book," and were used throughout a large portion of the United States.

In October of 1913, Vivian was called to Chicago as secretary of the Independent Telephone Association of America, and rapidly built up, with the splendid co-operation received, a strong Independent organization of approximately four hundred companies.

In December, 1915, the Independent Telephone Association of America and the National Independent Association were absorbed by the United States Independent Telephone Association, and Mr. Vivian was made secretary-treasurer. This organization has grown until it now has a membership of eight hundred companies, which is the largest organization Independent telephony has ever known. During the past years (four) a great deal of work has been done through its Service Department.

In December, 1916, a text book on Long Distance Operating was published, known as "Standard Long Distance Operating Practices." This book has had a big demand, so that the original supply has become practically exhausted.

In October, 1916, the association published "Condensed Long Distance Operating Instructions," approximately 5,000 copies having already been sold.

During these years Mr. Vivian has conducted operators' schools in many portions of the United States.

He is a Mason, an official member of the Ravenswood M. E. Church, and superintendent of its Sunday School.

During Capt. Vivian's absence the Association office will be in charge of Miss F. K. Enking, assistant secretary-treasurer.

Court Denies Telephone "Explosion"

Mrs. Flossie Inman's $12,000 suit against the Spokane Home Telephone Company for injuries received when a telephone "exploded" was thrown out of court by Superior Judge John S. Jurey of Seattle, sitting in the local superior court at Spokane, Wash.

When the plaintiff had completed her testimony, Attorney Frank T. Post for the telephone company, moved for a dismissal of the case on grounds of insufficiency of evidence, and the motion was sustained.

Mrs. Inman claimed that the "explosion" occurred when she took down the receiver of a telephone in a neighbor's home. The court also heard that the Inmans were not subscribers of the telephone company, therefore were trespassers in using the telephone.

Price Cut for Cablegrams

The Western Union Telegraph Company has made special arrangements for cablegrams to soldiers, sailors and nurses in England and France at a minimum charge of six cents per word. The price ordinarily for a message was twenty-five cents per word, but it is reduced for the benefit of relatives and friends of the boys who are at the front in France.

Rate Increases Granted to Utilities

Commissions Allow 401 Out of 462 Applications, According to "Public Service" List

HUNDREDS of rate increases of all public utilities have been granted within the last year—401 out of 462 requests—by local and state commissions and large numbers of applications for such increases are now pending in the various states of the union.

This signifies one thing and that is that the public regulating bodies, after learning the facts, have found that utilities must have larger rates of service and larger rates of return if they are to remain in business and that they must remain in business for the good of the state. But it is not merely enough that they remain in business they must be able to keep up with the demands of growth and progress which these urgent times force upon them. To do that, as the regulating bodies evidently perceive, the utilities must have more nearly adequate rates. They must be treated as all other classes of business are treated —allowed to raise their prices to meet the rising costs of operation. Only a prosperous utility is worth while.

The following tables comprise increases that have been granted, for the most part by state or other public bodies, in thirty-six states and Canada. Some may not yet be confirmed. They do not include increases to street railways. These are presented on other pages to themselves. Nor do the following tables include by any means all increases made or granted within the last year, but they do show the comprehensive scope of the movement toward increasing the rates for public utilities. This very nation-wideness of the movement thwarts any invidious attempt to pretend that the upward tendency is due to anything but a recognition by public regulating officials of the justice and necessity of such increases.

One of the most interesting features of these large numbers of rate increases is that more have been granted in Massachusetts than in any other state. Massachusetts has for thirty years supervised the securities of public utilities. This is an effectual answer to those who claim that the demand for rate increases arises from overcapitalization. Surely there is no talk of "watered stock" in Massachusetts.

Besides these increases given below—between 200 and 300—other such increases are monthly being allowed in the various states and Canada and it would be impossible at the moment to present anything like a complete list. As will appear from the following tables gas rates have apparently made better progress with increases than others. This is due to several reasons, one of which is the difference in character and classification. When all the electric rate increases now made and pending are completed their numbers will show up quite as formidably.

City—	*Utility.*	*Company.*
California.		
Fowler	Gas	Fowler Gas Co.
Huntington Beach	Gas	Huntington Beach Gas Co.
Newport Beach	Gas	West Coast Gas Co.
San Jose	Gas	Gas & Electric Co.
San Francisco	Gas	Pacific Gas & Electric Co.
Oakland and San Francisco	Electric	Great Western Co. and City Electric Co.
Colorado.		
Colorado Springs	Gas	Colorado Springs Light, Heat & Power Co.
Colorado Springs	Electric	Colorado Springs Light, Heat & Power Co.
Colorado Springs	Steam Heating	Colorado Springs Light, Heat & Power Co.
Connecticut.		
Wallingford	Gas	Wallingford Gas Light Co.
Thompsonville	Gas	North Connecticut Light & Power Co.
Middletown	Gas	Middletown Gas Light Co.
Hartford	Gas	Hartford City Gas Co.
Derby	Gas	Derby Gas Co.
Danbury	Gas and Electric	Danbury & Bethel Gas & Electric Light Co.
Meriden	Gas	Meriden Gas Light Co.
Hartford	Electric	Hartford Elec. Light Co.
Meriden	Electric	Meriden Electric Light Co.
Bristol	Steam Heating	Bristol & Plainville Tramway Co.
Delaware.		
Wilmington	Gas	Wilmington Gas Co.
Florida.		
Gainesville	Gas	Co-operative Ice Mfg. Co.
Georgia.		
Atlanta	Steam Heating	Georgia Ry. & Power Co.
Idaho.		
Boise	Gas	Boise Gas Light & Coke Co.
Illinois.		
Belleville	Gas	Belleville Gas Co.
Princeton	Gas	Princeton Gas Co.
Aurora	Steam Heating	Aurora Electric Co.
Alton	Steam Heating	Alton Gas & Electric Co.
DeKalb	Steam Heating	DeKalb-Sycamore Electric Co.
Indiana.		
Muncie	Electric (Power)	Muncie Electric Light Co.
Indianapolis	Electric	Indianapolis Light & Heat Co.
Indianapolis	Electric	Merchants' Heat & Lt. Co.
Princeton	Gas	Princeton Gas Co.
Anderson	Gas	Central Indiana Gas Co.
Ft. Wayne	Gas	No. Ind. Gas & Elec. Co.
Brazil	Gas	Brazil Gas Co.
Noblesville	Gas	Indiana Gas Light Co.
Tipton	Gas	Indiana Gas Light Co.
Bedford	Steam Heating	Interstate Pub. Service Co.
Fowler	Steam Heating	Interstate Pub. Service Co.
Lebanon	Steam Heating	Interstate Pub. Service Co.
New Castle	Steam Heating	Interstate Pub. Service Co.
Bloomington	Steam Heating	Central Indiana Light Co.
Terre Haute	Steam Heating	Citizens' Mut. Heating Co.
Iowa.		
Ottumwa	Electric	Ottumwa Ry. & Light Co.
Waverly	Gas	Waverly Gas Co.
Marengo	Gas	Marengo Gas Co.
Red Oak	Steam Heating	Red Oak Electric Co.
Cedar Rapids	Steam Heating	Iowa Railway & Light Co.
Marion	Steam Heating	Iowa Railway & Light Co.
Boone	Hot Water	Iowa Railway & Light Co.
Perry	Hot Water	Iowa Railway & Light Co.
Traer	Steam Heating	Iowa Railway & Light Co.
Iowa Falls	Hot Water	Iowa Railway & Light Co.
Manchester	Steam Heating	Iowa Railway & Light Co.
Kansas.		
Kansas City	Natural Gas	Cities' Service Co.
Independence	Natural Gas	Cities' Service Co.
Independence	Gas	Independence Gas Co.
Lawrence	Natural Gas	Citizens' Light, Heat & Power Co.
Topeka	Gas	Consumers' Light, Heat & Power Co.
Kentucky.		
Winchester	Natural Gas	Central Ky. Nat. Gas Co.
Hartford	Electric	Kentucky Lt. & Power Co.
Louisville	Steam Heating	Louisville Gas & Elec. Co.
Maine.		
Biddeford	Gas	York County Power Co.
Portsmouth	Gas	Portsmouth Gas Co.
Bangor	Gas	Bangor Gas Light Co.
Maryland.		
Baltimore	Gas	Consolidated Gas, Electric Light & Power Co.
Crisfield	Gas	Crisfield Lt. & Power Co.
Elkton	Gas	Elkton Gas Co.

City—	*Utility.*	*Company.*
MASSACHUSETTS.		
New Bedford	Electric	New Bedford Gas & Edison Light Co.
Fittsfield	Electric	Pittsfield Electric Co.
Fall River	Electric	Fall River Elec. Light Co.
Lowell	Electric (Provisional)	Lowell Elec. Light Corp.
Westfield	Gas	Westfield Gas & Elec. Co.
Spencer	Gas	Spencer Gas Co.
Weymouth	Gas	Old Colony Gas Co.
East Braintree	Gas	Old Colony Gas Co.
Ware	Gas	Ware Gas Light Co.
Brockton	Gas	Brockton Gas Light Co.
Cambridge	Gas	Cambridge Gas Light Co.
New Bedford	Gas	New Bedford Gas & Edison Light Co.
Springfield	Gas	Springfield Gas Light Co.
Chicopee	Gas	Springfield Gas Light Co.
South Hadley	Gas	Springfield Gas Light Co.
Longmeadow	Gas	Springfield Gas Light Co.
West Springfield	Gas	Springfield Gas Light Co.
Agawam	Gas	Springfield Gas Light Co.
Worcester	Gas	Worcester Gas Light Co.
Malden	Gas	Malden & Melrose Gas Light Co.
Quincy	Gas	Citizens' Gas Light Co.
Amesbury	Gas	Amesbury & Salisbury Gas Co.
Revere	Gas	Suburban Gas & Elec. Co.
Pittsfield	Gas	Coal Gas Co.
Salem	Gas	Salem Gas Light Co.
Peabody	Gas	Salem Gas Light Co.
Newburyport	Gas	Newburyport G. & El. Co.
Boston	Steam Heating	Edison Electric Illuminating Co.
Worcester	Steam Heating	Worcester Elec. Light Co.
MINNESOTA.		
Minneapolis	Electric	Minneapolis Gen. Elec. Co.
Albert Lea	Steam Heating	Minnesota Gas & Elec. Co.
Duluth	Steam Heating	Duluth Edison Elec. Co.
St. Paul	Steam Heating	Northern States Power Co.
Faribault	Electric and Gas	Northern States Power Co.
Eveleth	Steam Heating	Minneapolis Utilities Co.
MISSOURI.		
Kansas City	Natural Gas	Cities' Service Co.
Independence	Gas	Jackson Co. Light, Heat & Power Co.
Mexico	Steam Heating	Mexico Power Co.
Kansas City	Steam Heating	K. C. Light & Power Co.
MICHIGAN.		
Marshall	Gas	Marshall Gas Light Co.
Bay City	Gas	Michigan Light Co.
Cadillac	Gas	Cadillac Gas Light Co.
Marquette	Gas	Marquette Gas Light Co.
Detroit	Steam Heating	Detroit Edison Co.
NEW HAMPSHIRE.		
Portsmouth	Electric	Rockingham County Light & Power Co.
Portsmouth	Gas	Portsmouth Gas Co.
NEW YORK.		
Chuctanunda	Gas	Chuctanunda Gas Lt. Co.
Hornell	Gas	Hornell Gas Light Co.
Plattsburgh	Gas	Plattsburgh Gas & El. Co.
Amsterdam	Gas	Chuctanunda Gas Lt. Co.
Oswego	Gas	People's Gas & Elec. Co.
Ithaca	Gas (Discount abolished)	Ithaca Gas & Electric Co.
Medina	Gas	Medina Gas Co.
Rochester	Steam Heating	Rochester Ry. & Light Co.
Hornell	Steam Heating	Hornell Electric Co.
New York	Steam Heating	New York Steam Co.
Lockport	Steam Heating	Lockport Light, Heat & Power Co.
Avon (and adjacent towns)	Natural Gas	Pavilion Natural Gas Co.
NORTH CAROLINA.		
Elizabeth City	Gas	Southern Gas Imp. Co.
Henderson	Gas	Southern Gas Imp. Co.
Goldsboro	Gas	Goldsboro Gas & Fuel Co.
New Bern	Gas	New Beru Gas & Fuel Co.
Fayetteville	Gas	Fayette Light & Power Co.
Washington	Gas	Washington Gas Co.
Wilmington	Gas	Tidewater Power Co.
NORTH DAKOTA.		
Devils Lake	Steam Heating	General Utilities Corpor'n.
Enderlin	Steam Heating	General Utilities Corpor'n.
Oakes	Steam Heating	General Utilities Corpor'n.
Grand Forks	Steam Heating	Red River Power Co.
NEBRASKA.		
Lincoln	Steam Heating	Lincoln Heat, Light & Power Co.
OHIO.		
Columbus	Electric	Columbus Power & Lt. Co.
Columbus	Electric	Columbus Railway, Power & Light Co.
Cleveland	Electric (Provisional)	Cleveland Electric Illuminating Co.
Springfield	Electric	Springfield Light, Heat & Power Co.
Toledo	Electric	Toledo Rys. & Light Co.
Massillon	Electric	Massillon Gas & Elec. Co.
Warren	Electric	Trumbull Pub. Serv. Corp.
Portsmouth	Gas	Portsmouth Gas Co.
Akron	Gas	East Ohio Gas Co.
Delaware	Gas	Delaware Gas Co.
Dayton	Gas	Dayton Gas Co.
Dayton	Steam Heating	Dayton Power & Light Co.
Toledo	Hot Water	Wildwood Service Co.
Fremont	Hot Water	Ohio Light & Power Co.
Toledo	Hot Water	Toledo Rys. & Light Co.
Springfield	Steam Heating	Springfield Light, Heat & Power Co.
Coshocton	Hot Water	Ohio Service Co.
Alliance	Gas	Alliance Gas & Power Co.
OREGON.		
Portland	Steam Heating	Northwestern Electric Co.
OKLAHOMA.		
Nowata	Gas	Nowata County Gas Co.
Delaware	Gas	Nowata County Gas Co.
PENNSYLVANIA.		
Uniontown	Gas	Fayette County Gas Co.
Warren	Gas	Pennsylvania Gas Co.
Erie	Gas	Pennsylvania Gas Co.
Pittsburgh	Gas	Allegheny Heating Co.
Lewiston	Gas	Penn Central Light & Power Co.
Clarion	Natural Gas	Clarion Gas Co.
Greenville	Gas	Greenville Gas Co.
Grove City	Natural Gas	Union Heat & Light Co.
Mercer	Natural Gas	Mercer Heat & Light Co.
Oil City	Natural Gas	United Natural Gas Co.
Lebanon	Gas	Lebanon Gas & Fuel Co.
Altoona	Electric	Central Light & Power Co.
Pottsville	Steam Heating	Pottsville Steam Heat & Power Co.
York	Steam Heating	Edison Light & Power Co
Clearfield	Steam Heating	Pennsylvania Pub. Ser. Co.
Wilkes-Barre	Steam Heating	Wilkes-Barre Co.
Shenandoah	Steam Heating	Shenandoah Light, Heat & Power Co.
Hazleton	Steam Heating	Hazleton Steam Heat. Co.
Philadelphia	Steam Heating	Overbrook Steam Heat Co.
West Chester	Steam Heating	Philadelphia Suburban Gas & Electric Co.
Easton	Steam Heating	Pennsylvania Utilities Co.
Norristown	Gas	Norristown Steam Heat Co.
RHODE ISLAND.		
Pawtucket	Electric	Blackstone Valley Gas & Electric Co.
Tiverton	Electric	Tiverton Elec. Light Co.
SOUTH CAROLINA.		
Rock Hill	Gas	Rock Hill Gas Co.
SOUTH DAKOTA.		
Sioux Falls	Electric	Northern States Power Co.
TENNESSEE.		
Chattanooga	Gas	Chattanooga Gas Co.
UTAH.		
Salt Lake City	Steam Heating	Utah Power & Light Co.
VIRGINIA.		
Richmond	Electric (Provisional on new contracts)	Virginia Ry. & Power Co.
WASHINGTON.		
Seattle	Steam Heating	Puget Sound Traction, Lt. & Power Co.
Tacoma	Gas	Tacoma Gas Co.

Wisconsin.		
LaCrosse	Gas	LaCrosse Gas & Elec. Co.
Sheboygan	Gas	Sheboygan Gas Light Co.
Manitowoc	Gas	Manitowoc Gas Co.
Kenosha	Hot Water	Wisconsin Gas & Elec. Co.
Milwaukee	Steam Heating	Wisconsin Edison Co.
Milwaukee	Steam Heating	North American Co.
Mayville	Telephone	Mayville Rural Tel. Co.
Loganville	Telephone	Logan Telephone Co.
Crivitz	Telephone	Crivitz Rural Tel. Co.
Richland	Telephone	Richland Telephone Co.
LaCrosse	Telephone	LaCrosse Interurban Telephone Co.
Spooner	Telephone	Spooner-Evergreen Valley Telephone Co.
Marshfield	Telephone	Marshfield Telephone Exchange.
Tomahawk	Telephone	Tomahawk Light, Telephone & Imp. Co.
Augusta	Telephone	Augusta Light & Telephone Co.
Amherst	Telephone	Amherst Telephone Co.
Oxford	Telephone	Marquette and Adams Co. Telephone Co.
Elcho	Telephone	Elcho Telephone Co.
Wyocena	Telephone	Pacific & Wyocena Telephone Co.
Ettrick and Galesville	Telephone	Ettrick Telephone Co.
Strum	Telephone	Strum Telephone Co.
Nelsonville	Telephone	Nelsonville Telephone Co.
Fitchburg	Telephone	Dane County Rural Telephone Co.
Badger	Telephone	Badger Telephone Co.
Baldwin	Telephone	Baldwin Telephone Exch.
Oconto	Telephone	Oconto Rural Tel. Co.
Ashland	Water	Ashland Water Co.
Mellen	Water	Peoples Water, Light & Power Co.
Antigo	Gas	City Gas Co.
West Virginia.		
Charleston	Natural Gas	United Fuel Gas Co.
Coalburg	Natural Gas	United Fuel Co.
Grafton	Gas	Pittsburgh & West Virginia Gas Co.
Wheeling	Gas	West Virginia Traction & Electric Co.
Canada.		
Toronto	Gas	Consumers' Gas Co.
Winnipeg	Gas	Winnipeg Electric Ry. Co.
Hamilton	Gas	Dominion Natural Gas Co.
Galt	Gas	Dominion Natural Gas Co.
Paris	Gas	Dominion Natural Gas Co.
St. George	Gas	Dominion Natural Gas Co.
Dundas	Gas	Dominion Natural Gas Co.
Binbrook	Gas	Dominion Natural Gas Co.
Bartonville	Gas	Dominion Natural Gas Co.
Dunnville	Gas	Dominion Natural Gas Co.
Cayuga	Gas	Dominion Natural Gas Co.
Selkirk	Gas	Dominion Natural Gas Co.
Jarvis	Gas	Dominion Natural Gas Co.
Hagersville	Gas	Dominion Natural Gas Co.
Vittoria	Gas	Dominion Natural Gas Co.
Somcoe	Gas	Dominion Natural Gas Co.
Lyndoch	Gas	Dominion Natural Gas Co.
Vienna	Gas	Dominion Natural Gas Co.
Tillsonburg	Gas	Dominion Natural Gas Co.
Delphi	Gas	Dominion Natural Gas Co.
Pt. Dover	Gas	Dominion Natural Gas Co.
Pt. Rowan	Gas	Dominion Natural Gas Co.
Walpole	Gas	Dominion Natural Gas Co.
Rainham	Gas	Dominion Natural Gas Co.
Canboro	Gas	Dominion Natural Gas Co.
Chatham	Steam Heating	Chatham Steam Heat Co., Ltd.
Kitchener	Steam Heating	Consumers' Steam Heating Co.

The Youngstown, Ohio, city council, in a telegram to E. A. Reed, general manager of the Central Union Telephone Company at Columbus, said that unless immediate improvement was noted in local telephone service, injunction proceedings would be started to prevent the Youngstown company collecting tolls.

Railroad Wire Men for Service

Two battalions are being organized in Chicago for service in the telephone and telegraph departments of the railroads now being operated by American railway regiments in France. The recruiting is being carried on under the supervision of Colonel Leonard B. Wildman of the signal corps of the regular army. Each battalion will have the following organization: (1) One major (superintendent of telegraph); first lieutenant, adjutant (assistant superintendent and chairman of discipline board); first sergeant, acting sergeant major (chief clerk of office); three privates, attached to headquarters as orderlies and drivers (junior clerks and messengers). (2) Supply detachment—one first lieutenant, supply officer (electrical engineer in charge of supplies); one sergeant, battalion supply sergeant (supplies accountant); four privates, first class, clerks and drivers. (3) Two telegraph companies, each of which will be organized as follows: One captain (division operator); two first lieutenants (assistant division operators); two master signal electricians (one wire chief and one supervisor of signals); seven sergeants, first class (four train dispatchers, one foreman telegraph and telephone linemen and maintainers, one foreman of signals, one instructor and examiner of train rules); eleven sergeants (seven in charge of more important towers and offices; two assistant foremen telegraph and telephone linemen and maintainers; two assistant foremen of signals); seventeen corporals (nine towermen and operators, three telegraph and telephone maintainers, five signal maintainers); two cooks; one horseshoer (mechanic); forty-eight privates, first class (thirty-three telegraphers, six telegraph linemen and maintainers, eight signal maintainers, one barber); twelve privates (five telegraphers, four telegraph linemen and maintainers, three signal maintainers).

The two battalions now being organized in Chicago are headed by Major Frank W. Sherwood, for nineteen years in military service, and at one time a manager and wire chief of a Western Union Telegraph office, and by Major P. Kirk Pierce of the Pere Marquette, Grand Rapids, Mich.—*Railway Age Gazette.*

Michigan Commission Fight Grows

Many Michigan cities are taking an active interest in the telephone case now pending in the Ingham circuit court, in which Traverse City is contesting the right of the Michigan railroad commission to ignore franchise provisions and to permit telephone companies to charge higher rates than that agreed upon and restricted by city franchises.

Kalamazoo has agreed to furnish whatever aid may be necessary in the way of money, counsel or influence in winning the case for Traverse City, the council having voted such action. Flint, Bay City, Battle Creek and about 25 other cities have fallen in line with Traverse City, Detroit and Kalamazoo, although Grand Rapids thus far has taken no definite action. Attorneys Shelby B. Schurtz of Grand Rapids and Parm C. Gilbert of Traverse City are acting as counsel for the municipality. When a similar case came up before the railroad commission a year ago, Corporation Counsel Harry J. Dingeman of Detroit refused to appear before the body when hearings were started to raise the telephone rates in Detroit. The commission failed to press the case, but it later turned up at Traverse City.

Losses By Fortuitous Events

Testimony in the San Francisco Gas And Electric Rate Case Before the Master in Chancery

BY C. E. GRUNSKY

LOSSES of magnitude which result from floods, earthquakes, volcanic eruptions and the like and, in general, losses against which the owner can not insure, belong to a class of sacrifices, which like those due to obsolescence should be made good to the owner of the utility after the event, by the public, that is to say, by the rate-payers. Such losses can not be forecast. They should not fall entirely on the owner of the utility. In some fashion and to a fair extent, they should, in the course of time, be amortized out of earnings. As a rule no provision for other than ordinary risks is made in the allowed rate of return. Consequently, after a catastrophe, for which the owner is not responsible, but which entails a large investment of new capital to rehabilitate a public utility plant, there should be some provisions for amortizing the loss. It will, in such event, be better to let the amortization take place within a reasonable time rather than to carry an equivalent sum in the rate-base as though it were a permanent though unproductive, interest-bearing investment.

It will perhaps be claimed by some, that such losses should not be differentiated from the ordinary losses due to unforeseen causes, and that whatever hazard is involved in any enterprise has unqualifiedly been assumed by the owner of the utility. Under such a theory the allowance for hazard should at all times be liberal enough to compensate the owner for the chance which he takes of at some time suffering material loss. He would be compelled to take the gambler's chance and the rate-payer should stand the higher rate. Under such a practice there would be an owner here and there who would suffer large loss, while the great majority of owners, escaping the great catastrophes, would get what really should be paid, in the exceptional case, to the unfortunate owner. Under such a treatment of this matter, the tax for the risk would fall upon those who are paying rates before a catastrophe occurs, as well as upon those who receive service from rehabilitated works. The more logical procedure would be to relieve the ratepayers from the burden of making the inadequate provision for catastrophes which may never occur and letting the loss that actually results from a catastrophe be met out of future earnings. The usual provision for meeting losses which result from such fortuitous events as are here under discussion, is inadequate. The owner does not, as in the case of losses which must be made good by assurance companies, get the full benefit of the allowance for risk which is distributed in small measure or is at least supposed to be distributed among all public utility owners and is supposed to be collected in the earnings. The owner's share in this risk allowance is only a proportionate one while the loss, when it occurs, can not be distributed to the other utilities of the country which escape such loss, but falls in its entirety upon the one utility that may be affected thereby.

In recognition of the fact that most utilities escape such losses, the usual allowance in the public utility rates for the element of risk is small and probably in most cases negligible. The allowance for management, for business hazards, together with the allowance for participation in the general prosperity of the country, in short the profit allowance, would probably in few, if any cases, be materially reduced, if this element of risk were entirely eliminated.

In all cases in which the interpretation of the present day procedure is substantially true, it would be unfair to an owner whose public utility plant sustains material damage, by flood, by earthquake or by other fortuitous event, against which insurance is impossible, to let the entire loss fall upon him without recourse. That such losses should in some way utimately fall upon those who are served by the utility seems self-evident. The most equitable procedure would be to let them be borne by the rate-payers before the event as well as by the rate-payers of the future. But as they can not be foreseen the practical alternative would seem to be to let them fall in the future as would be the case if the utility were publicly and not privately owned.

In the case of a business not subject to regulation the opportunity to make up for past losses exists if larger profits can be made by charging what the traffic will bear. Owners of public utilities should be allowed to recoup their losses, if they can do so without charging rates unreasonably high.

That American System in France

According to a press dispatch, when the first of the American expeditionary forces reached a French port, an American general expressed a wish to report to General Pershing, who was in Paris. He was conducted to the port postoffice where the long distance lines of the government telephone system converge.

"Number 23, if you please, sir," the telephone operator said to the officer when he gave her his call for General Pershing.

"Twenty-three?" returned the general in astonishment. "What does that mean?"

"Twenty-three calls before you, Monsieur le General. Your turn will come in about four hours——"

"Cancel the call," ordered the general, at the same time calling his chief of staff.

"String up four telephone wires between here and Paris and start work at once. Use the poles of the French system."

The telephone men of the American Army were at work in five minutes. In ten, the general was surrounded by a veritable hierarchy of French government telephone officials, large and small, each excitedly expostulating.

The French officials protested, and they argued. "A commission must decide, permission must be obtained, an authorization was necessary," they said. All was to no avail. While they talked the American soldiers kept on stringing wire. The line went through and is now in use.

Kinloch Girls Get Increase

Increases in pay of all operators employed in the St. Louis, Mo., district of the Kinloch Telephone Company have been announced, effective November 1. The pay of experienced operators was raised from $45 to $50 a month and beginners from $20 to $25 a month, with a $10 a month increase for supervisors and chief operators.

An official of the Kinloch Company said the increases were part of the plan for general wage advances in all departments. The linemen got additional pay November 1.

Final Report on Inductive Interference

Review of the Work of the California Joint Committee

WITH the presentation of its final report, dated September 28, 1917, the Joint Committee on Inductive Interference, which has been investigating for the past five years, under the auspices of the California Railroad Commission, the disturbances in communication circuits caused by induction from neighboring power circuits, announces the conclusion of its work.

A preliminary report was rendered by the Committee in 1914. Besides a discussion of technical features of the problem, rules were recommended to the California Commission, to regulate the practices of companies operating power and communication lines in proximity to each other. These recommendations were embodied in General Order No. 39 of the Commission, which has been in force since August, 1914. These reports were published in TELEPHONE ENGINEER.

The final report just issued and based on more extensive investigations conducted since 1914, includes:

1. A historical sketch, regarding the formation, personnel, organization, investigations, and finances of the Committee.

2. A review of the basic principles, comprising a simple statement of the nature of the subject, a summary of the facts established or agreed upon, and a concise statement of the guiding principles for the prevention of interference.

3. Recommendations for revised rules to govern the design, construction, and operation of power and communication lines and associated apparatus, to prevent or mitigate inductive interference, followed by explanatory comments.

The new rules mark a considerable advance both in substance and form as compared with the 1914 rules. The principle of co-operation in determining means for avoidance or mitigation of interference is emphasized, in conjunction with definite guiding rules, where such are practicable. Certain precautionary measures are made applicable to all new construction. The principle of employing the remedial measure involving least total cost for a given benefit, irrespective of whose plant is changed, is declared. The arrangement of the rules has been entirely changed. A detailed summary of the recommended rules is given below.

An exhibit accompanying the rules, discusses the arrangement and spacing of power conductors.

4. Five appendices complete the report, dealing with:

(1) Interference not covered by recommended rules, which apply to constant-potential alternating current power circuits of over 5,000 volts between wires, or 2,900 volts to ground, and exclude telephone subscribers' loops.
(2) List of technical reports prepared by the Committee as a record of its investigations.
(3) Comments on the 1914 report.
(4) A bibliography.
(5) A chart showing the organization of the Committee.

The development of the power and communication services in California brought to a climax in 1912 the problem of interference by induction. The California Railroad Commission was called upon to adjudicate several cases of proposed power line construction paralleling long distance telephone, telegraph, and railway signalling lines, which had been protested by the telephone interests. Before these cases came to a formal hearing, however, the companies principally concerned reached an agreement, which was approved by the Commission, to make a field investigation of the physical conditions involved in such interference. About two months later the Commission called a conference of representatives of the various interests in California, which was held on December 16, 1912, resulting in the formation of the Joint Committee on Inductive Interference, composed of engineers representing the Railroad Commission, railroads, power, telephone and telegraph interests of the State. This Committee, which was authorized to investigate and report to the Commission, took over the field work which had already been started by the companies as referred to above.

Under a Sub-committee on Tests, experimental investigations were conducted upon several long parallels involving a 22 k. v., three phase, 60 cycle system isolated from ground, and a three phase, 60 cycle system with lines of 22, 33, and 55 k. v., having grounded neutrals at one or more points, with long distance telephone, telegraph, and railway signal lines. Most of these tests were made at Morgan Hill, Salinas and Santa Cruz, with the aid of a rather elaborate field laboratory, many of the tests being conducted with the power lines in normal operation.

A great amount of computation was required to analyze the experimental results, and besides this, theoretical studies were carried out. Much effort was required to develop suitable methods of measurement and to calibrate the instruments employed.

In the interest of a general survey of interference conditions in the State, information was collected from the several companies, concerning the parallels in which they were involved. Observations of the residuals of two grounded-neutral systems were carried out with a small portable outfit for measuring the magnitudes and frequencies of the harmonic residuals, at five different points besides those where the field laboratory was set up.

In giving its approval to the first report of the Committee, the Railroad Commission authorized the continuance of the investigation to secure more definite information concerning the effect of transpositions and the causes and effects of residuals. In carrying out this program, the field laboratory was moved to San Fernando where a 15 k. v. circuit, 37 miles in length, paralleled by a telephone circuit on the same poles, was entirely at the Committee's disposal for several months. During this time, the factors affecting the residual voltages and currents of power circuits whether isolated or with grounded neutrals; the effectiveness of transpositions in neutralizing inductive effects; and the magnitude of inductive effects in short uniform non-transposed sections of parallels, were experimentally investigated.

Investigations of residuals included the effects of transpositions, leakage, accidental grounds and frequency of alternations up to 1,000 cycles, for systems isolated from ground; and for grounded-neutral systems, the magnetic density of the transformers and various connections of the transformer banks. In the Transactions of the A. I. E. E., Volume 34, pages 2,113 to 2,125, a more

extensive description is given of the San Fernando investigations.

The matters experimentally investigated at San Fernando were made the subject of intensive theoretical studies. In conjunction with the work on induction in short uniform untransposed parallels, calculations were made to determine the accuracy with which the interference could be predicted by computation. Since June, 1915, the headquarters of the Field Engineering staff have been at San Francisco where these studies and the later work of the Committee have been carried out.

The results obtained at San Fernando showed that it was feasible to study by means of computations the effect of variation of spacing of conductors, separation of power and communication lines, size of conductors, heights above ground and configuration, on the intensity of induction. A study has been made covering the configuratons, relative positions, etc., most commonly occurring for three-phase lines, the results of which are embodied in Technical Report No. 65 of the Committee, comprising 214 curve sheets and over 3,000 curves.

Coincident with its investigations, the Committee arranged for tests by the American Telephone and Telegraph Company, Western Union Telegraph Company and the Postal Telegraph Cable Company to determine the detrimental effects of extraneously induced currents on the operation of telephone and telegraph receiving apparatus, that is, the interference due to specified amounts of current of a given frequency in telephone receivers and in telegraph relays.

The detailed record of the investigations of the Committee is contained in a series of 71 technical reports. Thirty of the reports have been selected as being of sufficient general interest to warrant their publication along with the two reports of the Committee to the California Railroad Commission. The reports include not only records of tests and their analyses, but give the methods of working, theoretical discussions, forms for systematizing experimental and theoretical work, and data of general usefulness in predetermining the magnitude of induction to be expected under given conditions and in prescribing remedial measures. All these reports are on file at the offices of the Railroad Commission in California, but unless they are published, the valuable information they contain will not be generally accessible. Their publication, however, is contingent upon the receipt of a sufficient number of orders substantially to defray the cost of printing and binding. All persons who are interested in procuring a copy of this publication are requested to notify Richard Sachse, Chief Engineer of the Railroad Commission of California, at San Francisco, to this effect.

Conditions of proximity of power communication lines that cause inductive interference are designated by the Joint Committee as "parallels." In preparing the final report, a large amount of study was given to the question of determining the conditions of length, separation, voltage, current, wave shape, balance, conductor arrangement, etc., that would constitute a "parallel." In order to set forth the relations in reasonably simple form, it was necessary to assign definite values to several factors which in practice vary widely in value and which it is usually not feasible to determine in particular cases. It was found that sufficient information was not at hand to satisfy all parties as to the assumptions regarding these factors. The Committee feared that a definition of these relations, based on such assumptions, would be used in cases where the assumptions did not apply. Consequently the report does not include such a definition. The record of work done on this complex problem remains, however, of great value as indicating the general method of attacking the problem, the difficulties to be overcome, and the accomplishment of results up to date.

The report gives the following as the seven "basic physical principles which underlie the rules recommended and which should guide all efforts to prevent inductive interference":

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangement of conductors.
5. Neutralization of induction by coordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High grade construction and care in the operation and maintenance of power circuits.

A brief summary of the recommended rules follows:

The first section entitled: "General Provisions" provides for: (a) Applicability of the rules. Rules on operation and maintenance are to apply throughout; rules for specific parallels, to cases hereafter created; rules not limited to lines involved in a parallel, to new construction, and in the event of reconstruction. (b) Co-operation. (c) Method of remedy involving the least total cost. (d) Existing parallels are to be cared for with due diligence, depending on the seriousness of their effects.

The second section consists wholly of definitions.

The third section entitled: "Location of Lines" requires: (a) Avoidance of parallelism wherever practicable. (b) Advance notice of intention to construct a line which will create a parallel. (c) The distance between parallel lines to be made as great and as uniform as practicable. Where other remedies fail, the separation is to be increased. (d) and (e) Parallels shall be as short and as free from discontinuities as practicable. Unnecessary crossings of highways are to be avoided.

The fourth section entitled: "Design and Construction of Lines" (a) Requires attention to quality and workmanship to prevent failures causing interference. (b) Consideration of the configuration of power circuits is required, also the avoidance of excessive spacing, long two wire branches from three phase lines, and single wire grounded circuits. (c) Power circuits are to be transposed throughout their lengths with barrels of 6 to 12 miles, excepting lines under 12.5 k. v. with grounded neutrals and certain lines located on private rights-of-way. Existing power circuits are to be transposed outside parallels hereafter created when necessary for capacitance balance, with regard to discontinuities. (d) Inside parallels an adequate transposition scheme, consisting of coordinated transpositions in the power and communication lines, if the latter are metallic, is to be installed, determined by co-operative study. In general, at least one barrel shall be placed in the power circuit. At highway separations from telephone lines, three mile barrels should ordinarily be employed. For parallels with telegraph lines six mile barrels are ordinarily sufficient. The most economical scheme and utilization of existing transpositions are to be considered.

The fifth section is entitled: "Design, Construction and Arrangement of Apparatus." It provides for: (a) Quality and arrangement of apparatus to minimize interference. (b) Rotating machinery should have good wave form. Grounds on generators are to be avoided, unless the arrangements are such as to avoid unbalancing the circuit and introducing residuals. (c) Transformer

exciting currents should be as low as is consistent with good practice (for most cases less than 10 per cent at normal voltage). Grounded single phase, grounded three-wire two-phase, and grounded open-star three-phase connections are prohibited. Star connected auto transformers with grounded neutrals on three-phase lines in parallels must also have low-impedance, delta-connected windings, or other equivalent means of suppressing triple harmonic residuals. (d) Auxiliary devices to prevent distortion of the waves by rectifiers, etc., are to be installed where necessary. (e) One oil switch with poles mechanically interconnected for simultaneous operation is required between a parallel and the source of supply of the power line to operate automatically in case of abnormal conditions, except where an operator is on duty. Consideration is to be given to switching arrangements to minimize transients. Where air-break or single-pole oil switches cause trouble, oil switches with poles interconnected are to be used. (f) Fuses are to be avoided for main lines in parallels. (g) Electrolytic lightning arresters are to be equipped to minimize their disturbing effects. (h) Indicating devices are to be provided at supply stations to give warning of abnormal conditions, and ammeters are to be installed in important neutral-ground connections. (i) Apparatus for metallic communication circuits is to be well balanced.

The sixth, and last, section is entitled: "Operation and Maintenance" and requires: (a) All reasonable care by power and communication interests to minimize interference and, in particular: (b) prevention of mechanical and electrical failures which would cause or promote transient disturbances and unbalanced loads. (c) Daily record of current in grounded neutrals of important stations. (d) Transformers are not to be operated at more than specified percentages above normal voltage. (e) Care shall be exercised to avoid switching disturbances. (f) Where lightning arrester charging disturbs, it should be done in the early morning. (g) A definite procedure shall be provided for station operators during times of abnormal unbalance on power lines involved in parallels. In general, the section of a faulty line passing a parallel should be disconnected until cleared, and not energized more than once in locating the fault. To facilitate the study of such cases, accurate records are to be kept of occurrences under abnormal conditions.

The entire work of the Joint Committee on Inductive Interference constitutes a notable example of the efficiency of co-operative work of engineers representing conflicting interests in lieu of methods of litigation based upon meager information concerning the underlying principles and facts of a complex problem. As perhaps the chief result of this effort on the part of the Joint Committee, there has been created in the State of California a realization of the seriousness of inductive interference, an understanding of practical preventive and remedial measures, and most important of all, a disposition on the part of the power and communication companies to co-operate in the solution of the problems which arise from the construction of the two classes of lines in proximity.

* * *

ANNOUNCEMENT OF PUBLICATION OF TECHNICAL WORK.

The Joint Committee on Inductive Interference, organized in December, 1912, by the California Railroad Commission and authorized to conduct an investigation of the problem of inductive interference to communication circuits by parallel power circuits has completed its work, after continuously investigating this subject for over five years, at a cost of over $100,000.

Some of the general conclusions have been published at different times during the progress of the investigation, but practically none of the technical data has thus far been made generally available. From time to time during the course of this work technical reports have been prepared which give the data obtained from the tests and the results and conclusions derived from both the tests and from theoretical studies. Thirty of these technical reports have been selected as being of such general interest and applicability as to warrant publication.

In addition to the technical reports the publication will contain final recommendations for rules for the prevention and mitigation of inductive interference and valuable historical matter concerning the investigation with general and technical discussions on the subject.

The book will have a complete index and contain approximately 1,000 pages, with over 400 drawings and 30 photographs.

The publication is contingent upon obtaining, in advance, a sufficient number of subscriptions to cover the actual cost of printing and binding, at not to exceed, and probably considerably less than, $10.00 per set (1 or 2 volumes).

Those interested in this problem will find these reports of considerable value. They are invited to enter their subscriptions and to fill out the attached blank and mail it at their earliest convenience. As the number of copies printed will be limited, only those subscribing in advance can be assured of receiving copies in the event the number of subscriptions justifies the publication. Those who place subscriptions will be advised as soon as possible whether the publication will be undertaken, and the approximate cost per set.

California Railroad Commission,
Attention Richard Sachse, Chief Engineer,
833 Market Street,
San Francisco, Cal.

Gentlemen:—Please enter my subscription for.....copies of the published reports of the Joint Committee on Inductive Interference, at a price not to exceed $10.00 per set.

Name.....

Address.....

A Telephone with Double Membranes

In the *Annales des Postes, Télegraphes et Téléphones*, an account is given of an interesting form of telephone receiver for which several advantages are claimed. It consists of a vessel furnished at its base with a membrane facing an electro-magnet, as in an ordinary receiver. But above this membrane is placed a hollow cone, the base of which contains a second membrane, parallel to and a few millimeters away from the first. The cone contains a second electro-magnet in series with the first one, both being traversed by the speaking current. As a result the hearing value is stated to be doubled. Moreover, the second membrane only covers about two-thirds of the first, and the annular space thus presented between the membranes and the ear has a favorable effect on the conduction of sound to the ear, tending to suppress inconvenient crackling effects and resonance. In addition, the condenser-effect of the telephone, which is generally regarded as the chief cause of resonance troubles, is considerably diminished by this new device. According to the patent the method is also applicable to microphones.

Loading Coils versus Repeaters

Properly Designed and Correctly Installed, Loading Coils Are Adequate for All Long Distance Work

BY W. N. FURTHMAN

IN the December issue of TELEPHONE ENGINEER it was shown that Dr. Pupin's Law involving the use of loading coils provides sufficient current at the receiving end of a 4,500-mile telephone line to give good transmission. Milli-ammeters have been designed and proven in as efficient that will measure the amount of current received. Evidence is at hand that loading coils have been used contrary to the provisions of Dr. Pupin's invention and have been associated with in efficient apparatus and cable. So they have been carrying, until very recently, other burdens than their own. No formula has been produced that shows the weakness of loading coils in transcontinental service nor for the strength and necessity of the use of repeaters in a circuit of this kind.

For over seventeen years Dr. Pupin's invention has stood the most searching examination and the most rigid of tests. Now that all of the fundamental features of loading a telephone circuit have expired, it is claimed that the telephone repeater supersedes the loading coil as a more efficient device, not only from an economical standpoint, but also from an engineering point of view. Another broad claim for the repeater states that loading coils would not be successful in transcontinental service unless repeaters were also added to the circuit to bring out to the greatest extent the benefits of loading a circuit.

It has been shown, from a mathematical standpoint, that the first contention is not correct. The writer's experience lends some weight to this statement. The second claim is subject to some scrutiny and, fortunately, evidence that cannot successfully be contradicted is at hand to assist us in our examination.

The first repeater used by the A. T. & T. Co. was invented in the year 1905 by H. E. Shreeve, a citizen of Great Britain and an engineer of the A. T. & T. Co., who

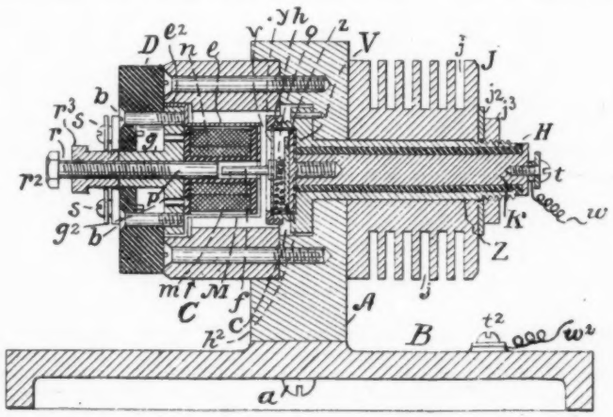


Fig. 1.

is now of the engineering staff of the Western Electric Company. A view of this device is shown in Fig. 1, and a general description of its claims for usefulness follows.

Telephone currents, even in short circuits, have no strength to spare, and in talking over long telephone lines they become so enfeebled in consequence of the increased resistance of the conductor and of leakage and other unavoidable losses that their effect upon the receiving telephone is correspondingly weakened and the reproduced conversation so faint and indistinct as to render the hearing and apprehension of the communication difficult and laborious, thus imposing a serious limitation upon the distance to which commercial transmission is at present possible. It is, therefore, most desirable that some way or means of reinforcing or renewing the current at the receiving end of the line or of enabling it to act upon the receiver with increased power, effectiveness and accuracy shall be found.

Various attempts have from time to time been made to devise electro-mechanical apparatus capable of replenishing the current at some intermediate point of the circuit or adapted to transfer the messages of one telephone circuit to another, and thereby either to increase the length of line that can be operated satisfactorily or under other conditions to enable the receiver to reproduce the transmitted message with increased loudness. These efforts, however, have uniformly been unsuccessful and

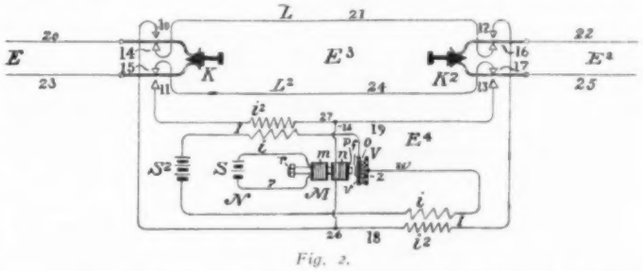


Fig. 2.

unproductive of practical result, and it is a fact that nothing of the kind is in practical or commercial use at the present time in connection with telephone circuits anywhere, for though in some instances the sounds reproduced by the receiver actuated by the replenished current have, indeed, been characterized by increased loudness, such increase has invariably been at the expense of clearness, and has always involved the loss of quality and the consequent introduction of so much distortion as to render the utterances of the receiving instrument inarticulate and unintelligible.

The objects of the present invention are to effectively reinforce or renew the talking currents traversing the line in such manner as to virtually compensate for their losses, to thereby so maintain their strength and assist their action at the receiving end of a long circuit that they shall be enabled to act upon the receiving telephone and cause it to operate for the reproduction of the transmitted sounds or conversation with substantially the same vigor, loudness and clearness as would be the case if the circuit connecting the transmitting and receiving instruments were direct and very short, or, in other words, to obtain the capability of retransmitting the message at any convenient intermediate point of the circuit or chain of circuits extending between the original transmitter and the ultimate receiver with renewed energy and without sacrifice of quality and generally the efficient and satisfactory transmission of conversation telephonically under practical and commercial conditions for greater distances and through longer circuits than has heretofore been practicable.

In carrying our Mr. Shreeve's invention, he employs and adapts for connection at any point between transmitting and receiving stations of a telephone circuit or series or sequence of circuits an organization comprising a variable receiving magnet responsive to the talking currents of such transmitting station and a variable resistance medium mounted in operative relation to the said receiving magnet, to be acted upon thereby and arranged to forward the talking currents with renewed energy and without impairment of their quality characteristics to such receiving station for the more perfect operation of the receiving instrument there.

In the development of this invention it has been found important (keeping in mind the character, delicacy and minuteness of the forces engaged, the smallness of the motion and the functions to be exercised) that the inertia of the moving parts shall be as small as possible, that the magnetizing and the magnetization-varying forces shall be so organized and disposed that the maximum effect of the latter upon the former shall occur at the strongest part of the common field, that the maximum effect of both may be concentrated directly upon the active or movable member of the transmitting medium and preferably upon

*Transmission Engineer, Kellogg Switchboard and Supply Company.

the most sensitively mobile part or point thereof, and that provision shall be made to facilitate the expeditious dissipation of the heat developed in and by the operation of the transmitting medium. These principles are exemplified by the present invention and in its receiving and transmitting elements, which are closely associated in a single instrument.

The receiving factor comprises a magnet constituting the required initial magnetic field, a magnetization-varying coil, to be connected with the main circuit of the original transmitter to receive the talking current thereof and encompassing the end of the magnet, which thus serves as a fixed core or pole piece entering such coil to have its magnetization varied thereby, and a

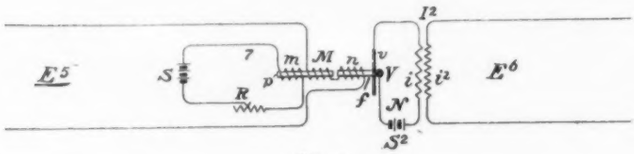


Fig. 3.

short and light piece of iron which forms a movable pole piece whose end is closely adjacent to that of the fixed pole piece in the magnetic field. The transmitting factor closely confronting the said coil is a variable-resistance microphone and has a movable contact or electrode, which, instead of being actuated by a vibratory diaphragm in the usual manner, is attached directly to the light movable pole piece of the receiving part of the apparatus, which thus constitutes a direct magnetic connection between the receiving magnet and the transmitting medium, and by this arrangement the diaphragm is dispensed with, the inertia of the moving parts reduced to a minimum and the requisite motion imparted to the movable electrode of the transmitting medium directly from the variable field, and preferably from the core of the varying coil, and therefore from the most effective part of said field.

The magnet establishing the initial field may be either an electro-magnet of any construction or form excited by a separate magnetizing coil in a special local circuit or a permanent magnet, such as that of the ordinary and standard telephone receiver. An electro-magnet is, however, to be preferred for this purpose, since in association with it an adjustable resistance may be included in its local circuit to regulate the strength of its current, and thereby the strength of the magnet, and thus of the initial field, to any desired degree. Furthermore, it is of distinct advantage to provide that the electro-magnet shall be of tubular form, having an iron shell, with the magnetizing and varying coils arranged concentrically therein, to surround the fixed core or pole piece, the said magnetizing coil being preferably outermost and the iron shell or casing arranged to entirely inclose both coils except at their front center, where an opening or perforation is provided to receive the movable pole piece attached to the transmitter electrode, which, passing through said opening into the varying coil, constitutes a portion of the magnetic circuit of the receiving magnet. For the avoidance of eddy currents the iron shell may be slit longitudinally down one side and to the center of its front plate.

The variable-resistance transmitting medium is of the "Hunnings" and "solid-back" types, wherein a mass of granular carbon is held inclosed in a flat chamber or hollow button between rigid and vibratory conducting disks (usually of carbon), which respectively constitute contact members or electrodes, one of which is vibratory or movable, the mechanical connection of the latter with the light movable pole piece of the receiving magnet being made at its center, that being the point or part most sensitive and most readily mobile and having the widest range of motion.

By inclosing the working parts of the apparatus, and particularly the transmitting element thereof, in a metal casing possessing, or in connection with, considerable mass and radiating surface and with which such working parts are in heat-conducting relation, an effectual means is provided for the prompt and continuous removal and dissipation of the heat, which during the operation of the instrument is generated in the transmitter button by the passage of the local-circuit current through the variable-resistance material and which if retained and permitted to accumulate acts to deprive the carbon granules of their microphonic property, and thus seriously impairs the operation of the transmitting medium.

The current-renewing apparatus may be associated with telephone main circuits in various ways. One circuit arrangement with which it has been successfully connected and employed is that represented by Fig. 11 (our Fig. 2), and, so far as concerns its receiving factor alone, by Fig. 14 (our Fig. 4) also. In this arrangement the apparatus is shown as being placed at the middle of a long circuit and between the sections *E E2* thereof, so that it is adapted to be operated indifferently and reciprocally from either end of the line and to renew the transmission, according to its direction, from either section of the line to the other.

K K2 represent keys or switches, which, when in position shown, maintain the direct connection of the circuit through the section *E3* thereof, the renewing or reinforcing apparatus being disconnected. In this position the circuit-conductor, *L*, is traceable between the section conductors, *20* and *22*, by way of the resting contacts, *14* and *16*, of keys *K* and *K2*, and their uniting conductor, *21*, while circuit conductor, *L2*, in like manner extends between its sections, *23* and *24*, through intermediate conductor *24* and its terminal contacts, *15* and *17*.

By moving the keys or switches, *K K2*, to their alternative position the conductors, *20, 23*, of circuit-section *E* are transferred from contacts *14, 15* to contacts *10, 11*, and the conductors *22, 25* of section *E2* from contacts *16, 17* to contacts *12, 13*, so that the intermediate section, *E4*, is substituted for *E3*. The magnetization-varying coil *n* of the renewing-apparatus receiving magnet is connected in a bridge, *u*, between points *26, 27* of the main conductors, *18, 19*, of the said intermediate section, *E4*, and si thus made common to both of the main sections, *E E2*, to be operated by the distant transmitter of either one—that is, of the terminal station of either section—according to the direction of transmission at any particular moment of time. The initial magnetic field of the receiving medium may be established by either one of the several plans indicated by Figs. 12, 13 or 14 (our Figs. 2, 3 or 4), respectively, but as hereinbefore stated, preferably by that of Fig. 14 (4). The transmitting medium (indicated conventionally) is included in the local circuit, *N*, and is adapted to have the resistance between its electrodes, *v* and *z*, varied by the strength variations of the magnet *M*, produced by the voice currents in the varying coil *n*. The primary circuit *N* also contains the primary windings *i* of induction coils *L*, whose secondary windings *i2* are connected one on either side of the bridge *u* and in the conductors, *18, 19*, respectively, so that one winding is in main section *E* and the other in main section *E2* of the through circuit.

It is to be understood that the drawings represent the electrical arrangement only and that in practice a single primary winding and two secondaries may be wound over a single core and into a single induction coil. A coil having a single primary winding of five hundred turns of No. 20 wire with a resistance of about one ohm, and two secondaries wound in parallel of twelve hundred and fifty turns and thirty ohms' resistance each of No. 29 wire, has been found to answer well, as has also a varying coil for the receiving magnet formed of fourteen hundred turns of No. 40 wire, having a resistance of about one hundred and thirty ohms.

If desired the apparatus may be employed, as in Fig. 12, in enabling one line circuit, *E5*, to transmit over a second and en-

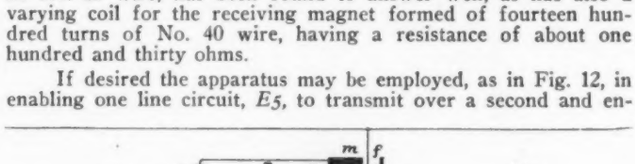


Fig. 4.

tirely separate circuit, *E6*. Thus engaged, the varying coil *n* of the receiving factor or agency, *M*, is connected in the transmitting circuit, *E5*, and its transmitting medium, *V*, in the primary local circuit, *N*, of the battery, *S2*, together with the primary winding *i* of an induction coil, *12*, whose secondary winding, *k2*, is wholly connected in the second circuit, *E6*.

It will be noted that the date of these claims is 1905, and as a matter of further information it can be stated that the application was filed in July, 1904. When it is remembered that Dr. Pupin's patent was issued in 1900 and assigned to the A. T. & T. Co. in that year, it is somewhat difficult to understand why the patent attorney of the Bell company should, in the first paragraph of his general claims, entirely overlook Dr. Pupin's prior claims of similar wording and of at least four years' earlier date. When it is stated, however, that the Western Electric

Company did not start to manufacture loading coils until after Shreeve's invention was granted, it is not so difficult to comprehend some patent claims.

Why was Dr. Pupin's patent not referred to in these claims? Simply because they covered the same contention. Another interesting feature of Mr. Shreeve's invention papers lies in the fact that they do not contain a single mathematical formula. Obtain a copy of patent No. 791,655, dated June 6, 1905, and look at it for yourself. Then obtain a copy of Dr. Pupin's patent, No. 652,230, dated June 19, 1900, and study the formulæ he sets forth. It will not be difficult then for you to understand whether the loading coil follows the repeater, or whether the repeater is the small part of the procession of loading coils that extend from Boston to 'Frisco at intervals 1 to 12 miles.

Another interesting feature of Mr. Shreeve's patent papers, as a matter of omission, is all reference to the use of tapering transformers, artificial lines and wave filters with repeaters. Why were all these important features of a repeater omitted? Simply because the engineers did not at that time know anything about the necessity of using such apparatus with repeaters. When did they find out repeaters would not work successfully without the addition of all these things? When they began to use them in practice on a loaded circuit. As soon as they found it out they sought for patents immediately on every one of them.

However, Mr. Shreeve did not obtain the patents on these other devices. Dr. Campbell and Messrs. Hoyt and Mills, also engineers of the A. T. & T. Co., got there first. Together they showed Mr. Shreeve how to make his repeater do things he never knew were in it. Did the Shreeve repeater then work satisfactorily? Not so but that Dr. De Forest, the wireless expert, was able to sell them another one. But that is another part of our argument about repeaters.

It will also be noted that in Mr. Shreeve's invention he points out the necessity of a variable resistance in the repeater circuit. Does this mean an operator must not only connect the repeater into the circuit, but must also regulate the local repeater circuit? Most assuredly. And another thing: she must also be able to insert inductance and capacity in the circuit and also vary these factors as required. Repeaters sing or howl, due to variations in the electrical constants of the line, and when they do, the operator finds it out by listening in on your toll connection at so much per second, and then plugs it out by trying to guess whether it is either one of these three unbalances. You can just about judge what kind of an engineer that girl is who can tell inductance, capacity or resistance unbalance by a singing or howling tone. The writer has made tests where cross-talk was caused by unbalances of all these and has found it necessary to eliminate all of them before the disturbance was removed. So it is with repeaters. It will be noted as we progress that it was finally necessary to install variable inductance and capacities in repeater systems.

Figs. 2, 3 and 4 illustrate the method of connecting the repeater into the circuit.

Demagnetization of Iron

As the magnetic state of a piece of iron does not depend merely upon the field intensity to which the iron is being subjected, but also upon the previous magnetic history of the iron, it is necessary to destroy the effects of previous magnetization before proceeding to magnetic tests. The destruction is generally effected by the method of reversals, the magnetizing current being reversed many times while its intensity is gradually being decreased to zero. The demagnetization thus obtained is frequently very incomplete, and in the case of an iron ring, which is a closed magnetic circuit, there would in such an instance be no external evidence of the remnant magnetism. Studying the measurement of magnetic induction and magnetic permeability recently in the University of Michigan, Mr. A. Whitmore Smith (*Physical Review* May and September, 1917) observed a very considerable time lag in the rise of the induction from the outside surface to the center of a bar which is being magnetized by a current sent through the solenoid surrounding the bar. Owing to the eddy currents which circulate in the iron in a direction opposite to that of the magnetizing current, the magnetic flux does not reach its full value until several seconds after the reversal of the magnetizing current. If, then, the magnetizing or the demagnetizing currents be reversed at too rapid a rate, there will be little effect upon a considerable portion of the interior of the iron. This consideration suggests demagnetization by current reversals at slow rates, and in his last paper on the demagnetization of iron Smith attempts to answer two questions: in what state will a given process of demagnetization leave the iron? and in what manner will the B-H curve or the μ-H curve be affected by the method used for the previous demagnetization? Four different methods of demagnetization were tried. In the first method an iron ring, previously magnetized by a continuous current of 1.5 ampere, was subjected to an alternating current of 60 cycles, the intensity of which was slowly reduced from 1.5 ampere to 0.02 ampere; the hysteresis curve afterwards taken showed that three-fourths of the residual magnetization was not removed by this treatment. Better results were obtained with stronger alternating currents of 16 amperes, and also when the reduction in the intensity was effected by withdrawing a copper wire from a liquid rheostat containing a plate electrode; in this case the alternating current would be partially rectified. In the second method demagnetization was tried simply by slowly reducing the magnetic field (continuous currents) to zero without any reversal; there was almost the same very imperfect demagnetization as in the first case. In the third method the continuous demagnetizing current was diminished and reversed by hand, with the aid of a mercury commutator, at the rate of one cycle per second; two-thirds of the magnetization was then left in the iron ring. All this was to be expected after the experiments on the serious time lag. Reversals were then made once every 10 seconds while the current intensity was reduced to zero in 12 steps, there being 10 reversals in each step. In this case the demagnetization was almost complete, the hysteresis curve being reduced to a very small loop about the origin. In the fourth method the current was reversed fewer times, but the intervals between the steps of the current reduction were made longer. The general conclusion drawn is that one reversal per second may be too rapid for demagnetization. The time required for the full reversal of the magnetic flux should be determined in each instance. This is done by closing the galvanometer key after reversing the magnetizing current and by noting the interval of t seconds, necessary in order that there should be no deflection; the reversal of the demagnetizing current should then not be faster than once in two t seconds. The t, it should be noted, is not constant for the same ring, being longer for regions of greater permeability.—*Engineering.*

When Sales of Goods Are Voidable

State Laws On Selling Not Ordinarily Observed

BY ELTON J. BUCKLEY

MY observation is that a thousand times every day sales of goods take place that are illegal and could be repudiated if either of the parties wanted to do it. Many of these sales go through merely because the parties don't know that they have ignored a law which is in force in practically all the states, prescribing the way in which sales of personal property, amounting to more than a certain sum, must be done. Sales not done in this way are bad.

I have had occasion to ask a great many business men, from time to time, whether they knew about this law, and most of them never heard of it. A very few had a hazy idea there was such a law, but they had never made any effort to obey it.

The law I refer to is everywhere called the "statute of frauds," and it comes to us from an old English statute. It exists in every state of the Union, so far as I know, and the part of it which has to do with the sales of goods is always in substantially the following language:

> A contract to sell or a sale of any goods of the value of $500 or upwards, shall not be enforcible by action unless the buyer shall accept part of the goods so contracted to be sold, or sold, and actually receive the same, or give something in earnest to bind the contract or in part payment, or unless some note or memorandum in writing of the contract or sale be signed by the party to be charged or his agent in that behalf.

The above is from the Pennsylvania act, which is peculiar in that it puts the amount of the contract which is to be controlled by the act so high. In many states the act reads "of the value of $50 or upwards," which of course makes the law much more far-reaching than an act putting the limit at $500.

Now, what does this law mean? A goes into B's store or office, and makes a verbal deal with him for so much merchandise. This of course happens. The parties know each other very well and they would disdain a written contract. If the above law were not in existence, that deal would be a complete legal contract when A left B, and either party could enforce it. But under the above law, provided it involves more money than the sum named in the act, it cannot be enforced, which means that either party can repudiate it at will, unless:—

1. The buyer accepts part of the goods or actually receives part. That, the law says, executes the contract, and the parties are bound. The buyer need not personally receive part of the goods. If anybody acting for him does it, it makes the contract good. For instance, if goods are sold f. o. b. the seller's station, the receipt of part or all of them by the railroad company is an acceptance by the buyer, for when goods are sold f. o. b., the railroad is the agent of the buyer.

2. Or the buyer must give some earnest or make part payment. This, too, executes the contract. Giving a note is not sufficient, though giving a check as a deposit would be.

(A few state laws do not contain this clause.)

3. Or a memorandum must be given of the sale, "signed by the parties to be charged." It used to be considered that this meant both parties, but it has later been decided that it means only the party who is trying to get out of the contract. That is, if in such a sale it is the seller who relies on the above act to let him out, the law will require that the memorandum, if there was one, bore the seller's signature. And vice versa if it is the buyer who is trying to escape.

What kind of a memorandum should be given to make the sale safe? It need not follow any prescribed form, but it should state the fundamentals of the contract clearly—the date, the names of the parties, the character of goods and the price. Given these, any form will do—pencil, ink, written or printed. A written offer to sell is enough if it is later accepted verbally, provided the party who signed the offer to sell is the one endeavoring to escape. Also a written acceptance of a verbal offer, if it is the *buyer* who this time is trying to escape. And a telegram is sufficient when it is signed with the right name.

Thousands of transactions are made on a broker's sales memorandum. A broker brings seller and buyer together, and when the deal is complete, he signs a sales memorandum and gives a copy to buyer and seller. Since under the law he represents both parties, his sales memorandum has always been considered sufficient under the above law to bind both parties.

Even if no memorandum was made and signed at the time, if you can get the other party to sign it later, he cannot thereafter get out of his bargain on the ground that the above law was not complied with.

Under many cases this act applies to future contracts as well as contracts for goods on spot. I think I should say also that it does not apply at all where the goods sold are made especially for the buyer and are not a part of a regular line kept in stock by the seller. Such sales are considered sales of labor rather than sales of merchandise, and people who handle them don't need to mind the law at all. A suit of clothes, made to measure for a customer, is a case in point. It would not be a part of the seller's regular line. But one hundred cases of tomatoes, such as the packer always puts up, would not be, even though they were packed especially to fill somebody's order.

(*Copyright, December, 1917, by Elton J. Buckley.*)

Government Needs Scientific Men

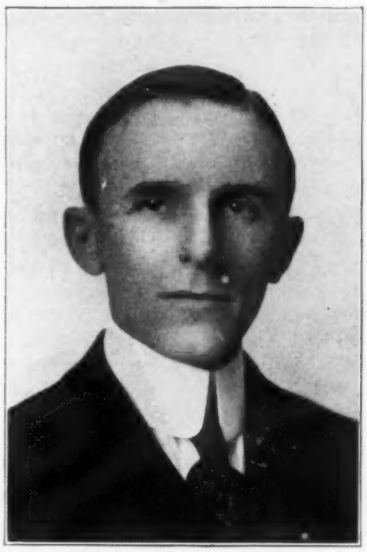
The following is a copy of a letter addressed to Dr. Hollis Godfrey, member of the Advisory Commission of the Council of National Defense, by Secretary of War Baker:

MY DEAR MR. GODFREY: The successful outcome of the war is so dependent upon the applications of science that the United States can ill afford at this time to risk any diminution of this supply of technically trained men. Such diminution we must in part suffer by reason of the fact that class exemptions in the execution of the selective service law are prejudicial to its general success; but I have constantly in mind the fact that the Government service will demand more and more scientifically trained men, and so I hope those who are in charge of scientific institutions will impress upon the young men the importance and desirability of their continuing their studies except to the extent that they are necessarily interrupted by a mandatory call under the provisions of the selective conscription law.

Some Recent Improvements in Telephony

Presented at a Section Meeting of American Institute of Electrical Engineers, Rochester, N. Y., October 26,

BY RAY H. MANSON



Chief Engineer Ray H. Manson, Stromberg Carlson Telephone Manufacturing Company.

TELEPHONY, like the other branches of the electrical art, has made notable progress during recent years. Improvements in the transmitting of articulate speech over greater distances and in the switching methods employed for interconnecting of telephone users' line circuits, are worthy of note.

In the attempt to improve the circuit switching equipment two distinct schools have been created, each backing a different system of operating. These systems can be designated as follows:

(a) The Centrally - Operated System.

(b) The Subscriber - Operated System.

The term "centrally-operated" applies to a system in which all of the labor of interconnecting of the telephone users' lines is done by human agency in the form of telephone operators at the central office. Because the final connecting of the lines at the central office portion of this system is done by hand method, the complete plant is popularly known as the "Manual Telephone System."

On the other hand, the term "subscriber-operated" designates a system in which purely machine methods are used at the central office for the interconnecting of the telephone users' lines. The human intelligence in this case is supplied by the telephone user (subscriber) who manually operates a mechanically governed circuit interrupting device a number of times, so as to produce the circuit switching changes in the central office. Because the central office portion of this system is made up mainly of mechanical switching mechanism, the complete plant is known as the "Automatic Telephone System."

The mechanism of both the centrally-operated and the subscriber-operated system have been reduced to a fairly high state of perfection. This paper, however, has to do only with the centrally-operated system and in particular with reference to a few examples which will indicate the trend of improvements now advocated and furnished in some modern telephone plants.

The centrally operated system is built around one principle, that of removing from the telephone user all of the labor of making the electrical connections to the desired telephone line, and the labor of calling the desired subscriber to the distant telephone, leaving this work to a few skilled operators located in the central office.

It is obvious that any device or circuit arrangement which will cut down the amount of work required by the operator in the establishing of a circuit connection between two subscribers will serve to improve the service as well as to reduce the total number of operators required for a given number of telephone lines.

Special service features provided by the so-called automatic listening, automatic ringing and flashing recall, can be given as examples of such improvements in modern centrally operated exchanges.

In the establishing of a connection between two subscribers' lines a linking circuit is employed in which the operator's listening, ringing and disconnecting equipment is provided. This linking circuit is known in the telephone field as a subscriber's cord circuit and terminates at both ends in plugs which are designed to make contact with the jacks which are used as terminals of the subscribers' lines. Each plug and each jack has terminals for 3 conductors, so that when a plug is inserted in a jack a complete circuit connection is made through 2 wires for talking purposes as well as through a third wire for local switching purposes.

AUTOMATIC LISTENING CIRCUIT:—When an operator plugs into a line to answer a calling signal, it has been customary to connect her telephone set by means of a hand operated key and to manually restore this key, so as to disconnect her telephone set, after the cord circuit is plugged into the desired subscriber's line.

In the automatic listening circuit shown in Fig. 1 this hand operation is done away with by providing a contact on the answering supervisory relay of each cord circuit, which will close when the answering plug of the particular cord is inserted in the jack of the line upon which a call is being made. The closing of this contact establishes a circuit for battery current through the winding of the listening relay and the back contact of the calling sleeve relay, which latter at this stage of the connection is in its normal position as shown. The listening relay thus is operated and connects the operator's telephone set directly to the tip and ring side of the talking circuit.

Now when the operator inserts the calling plug of this particular cord circuit into the jack of the desired line, the contacting of the sleeve of the plug with the sleeve spring of the line jack will establish a circuit for the central battery through the calling sleeve relay and the cut-off relay of the line. Both of these relays are energized and through the opening of the back contact of the calling sleeve relay the battery circuit for the listening relay is opened so that the latter restores to normal. Thus the operator's telephone set is automatically disconnected from the talking circuit of the connected lines.

In practice an automatic listening circuit contains other elements for safe-guarding its operation and for making it more flexible so as to meet all special telephone service requirements.

This automatic listening circuit, as shown in Fig. 1, will give "secret service" in-so-far as the operator is concerned, as no means is provided for the operator to cut in on an established connection between two subscribers. This secret service may be considered a desirable feature on small exchanges, but reduces the flexibility of the switchboard operation to such an extent that on large

systems emergency listening keys usually are provided. These keys are employed only in the handling of such calls as would otherwise interfere with the regular operation of the switchboard. In this case the secrecy of the service is guarded by the use of large pilot signals, which light when an emergency ringing key is operated and call the attention of supervising operators or others to this fact.

Automatic Ringing Circuit:—The so-called automatic ringing of subscribers' telephones is a service feature which benefits both the subscriber and the operator.

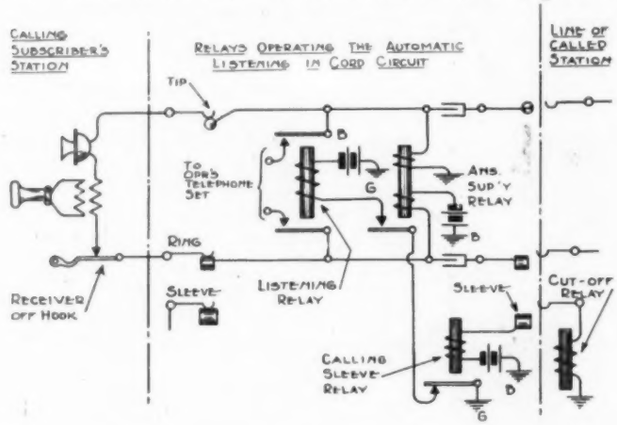


Fig. 1 - Simplified Automatic Listening Circuit.

In the case of a subscriber making a call the continuous intermittent ringing of the bell of the desired subscriber by machine methods calls for an immediate response. With the old hand method of ringing, the desired subscriber often failed to heed or to hear the one or two rings first made by the operator, requiring that the calling subscriber request the operator to ring again.

In the case of the operator the automatic ringing avoids the necessity of so closely monitoring each connection, as once the ringing key is set to call the desired subscriber, the operator's work in the establishing of a connection is complete.

Fig. 2 shows the fundamental elements employed in one form of automatic ringing. This sketch illustrates the condition of the circuit when the operator has plugged into the jack of the desired subscriber's line. Now the pressing of the ringing key establishes a circuit from the main exchange battery through a resistance coil *H* and the energizing winding of the ringing relay, through the key to the ground side of battery. This operates all three contact springs in the ringing relay, one of these springs closing a contact at *K* so as to retain the battery circuit through the winding of the ringing relay when the pressure on the ringing key is removed and the contact of the latter is opened. In other words the ringing relay then is locked in its ringing position. This allows ringing current to be intermittently connected to the cord circuit through an interrupter, the ringing current first passing through a non-inductive resistance *M* and winding of the tripping relay in multiple, thence through the telephone ringer and condenser and back through the tip side of line to the main exchange battery or to the ground of the ringing generator.

The tripping relay is provided with a copper sheath over the core, so as to act as a low resistance short-circuit turn of wire and thereby reduce the impedance of this winding to such a point that considerable ringing current can go through the tripping relay winding without completely pulling up the relay armature.

The battery connection to the tip side of line is interrupted in the called subscriber's station by the presence of the condenser which is in series with the ringer. However, when the called subscriber removes the receiver from the hook a path for this direct battery current is provided through the talking circuit of the telephone, the hook switch contact, the ring of the line, the tripping relay winding and the resistance *M* in parallel, to the ground on the interrupter or to the ground on the ringing generator. Under this condition the battery current positively operates the tripping relay. This actuation of the tripping relay, shunts the battery current to ground and away from the winding of the ringing relay so that the latter is restored, stopping the ringing.

A special feature of this circuit is the absence of marginal adjustments in the tripping relay. Any tendency of this relay to vibrate in unison with the frequency of the ringing current does not shunt the ringing relay battery current, as the release-time-element of the ringing relay is longer than the longest frequency period of the low frequency ringing current. However when battery current flows through the line circuit, due to the removing of the receiver from the hook switch, then the direct current alone or the superimposed direct current on the alternating ringing current, causes the tripping relay armature to be retained in its operated position, so as to give positive action.

This feature allows the tripping relay to have a sensitive adjustment so as to act positively when the receiver is removed from the hook of a telephone located on the end of a long high resistance line. This relay, with the same adjustment, will not operate with the heavy ringing current which is used to ring a full equipment of bridged party line bells on a short low resistance telephone line, to operatively release the ringing relay.

This automatic ringing circuit, Fig. 2, when in its complete form, includes safe-guards which will terminate the ringing if the calling party abandons the connection before the called party responds and so that when the called party has responded and is on the line, it is impossible for the operator to actuate the ringing relay and ring the subscriber in the ear.

Flashing Recall Circuit:—Many schemes have been devised for insuring prompt attention from the

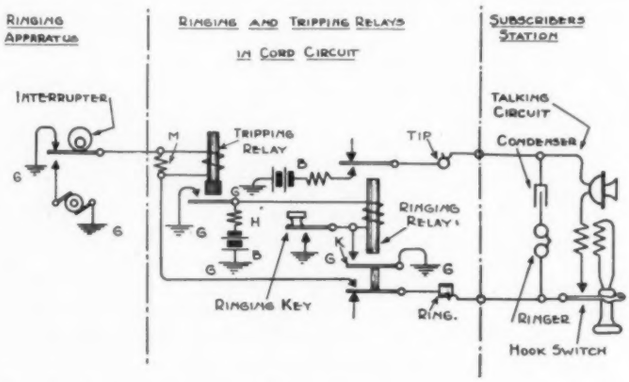


Fig. 2 - Simplified Automatic Ringing Circuit.

operator when a subscriber desires to make a call to a second party, immediately after finishing a conversation with a first party. Under ordinary conditions the hanging-up of a telephone receiver, after finishing a conversation, causes a supervisory lamp in the connecting cord circuit to become steadily lighted and serves as a signal to the operator that the conversation has been completed and that the cord circuit can be used for other service.

This working of the hook switch up-and-down by hand so as to flash this supervisory lamp, has been the customary means employed for obtaining the operator's attention for another call. This hand flashing of the signal does not prove completely satisfactory, for the subscriber usually fails to realize that the lamp does not flash distinctly unless the hook is worked slowly, also that the flashing has to be continued for an appreciable length of time to secure the operator's attention, which attention may be directed to other work during a brief flashing period. Then when the operator is free to direct her attention to the signal, this lamp will be lighted steadily, which is not a signal for a recall but for an ordinary disconnect.

To overcome this difficulty an automatic flashing recall has been provided as shown in circuit Fig. 3. Under normal conditions the hanging of the receiver on the hook switch lever, after conversation has been completed, allows the answering supervisory relay to be de-energized and to close a circuit from the central office battery through the answering supervisory lamp, back to the ground side of battery through a contact on the answering sleeve relay. This latter relay is in its energized position, due to the answering plug still being inserted in the jack of the calling line, as shown in the diagram.

A steady light from the answering supervisory lamp and another steady light from the calling supervisory lamp (not shown in diagram) indicates to the operator that the cord circuit is no longer required in this particular connection and is available for other service.

However, if the calling party desires to immediately get the attention of the operator for the establishment of a connection to another telephone line, then depressing the hook lever once is sufficient to substitute for the steady battery supply for the answering supervisory lamp, an interrupted battery supply, giving a flashing signal until the operator responds. This is brought about by the energizing of the flashing relay *F*, through a circuit

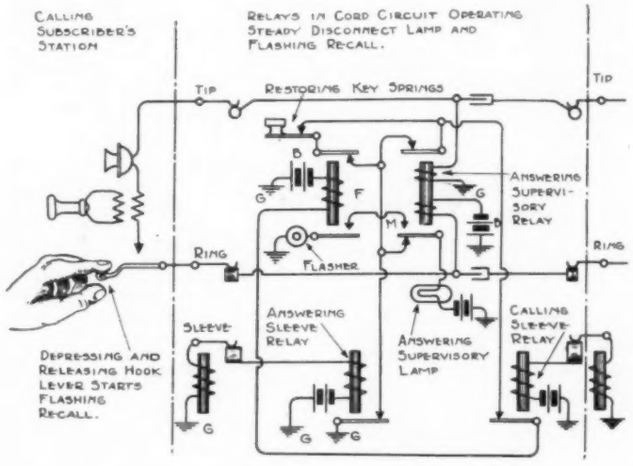


FIG. 3 - SIMPLIFIED FLASHING RECALL SYSTEM.

from the central office battery through the winding of this relay *F*, a closed contact of the calling sleeve relay, the upper closed contact of the answering supervisory relay and the upper closed contact of the flashing relay *F* in multiple, thence through the closed contact of the answering sleeve relay to the ground side of battery.

The reason for providing a second circuit through the upper contact of flashing relay *F* in multiple with the contact on the answering supervisory relay, is so that swering supervisory relay again energized. This re-establishes battery circuit for the answering supervisory lamp when the latter is again energized (due to raising of the hook-switch) that a locking circuit will exist for maintaining the flashing relay *F* in its operated condition. Now, if pressure is removed from hook switch at the calling telephone, its contact is again made and the an-

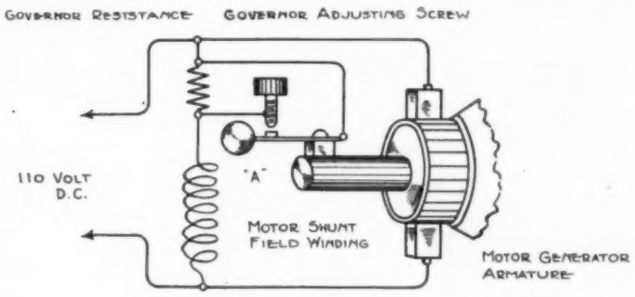


FIG. 4 - SPEED GOVERNOR USED ON MULTICYCLE MOTOR GENERATOR FOR HARMONIC RINGING.

through a new path which includes the contact *M* and the lower closed contact of the relay *F*, through the flashing interrupter and thence to ground side of battery. Thus the answering supervisory lamp is caused to flash continuously until the operator responds and restores the circuit to normal by means of the restoring key springs which form a part of the operator's emergency listening key.

SELECTIVE PARTY LINE RINGING:—The ideal telephone system is one having only one subscriber's telephone on each of the line circuits extending to the central office switchboard, so as to reserve the one circuit for the exclusive use of the one subscriber without the possibility of interference. There are several reasons, however, why it is not desirable to give each subscriber in the exchange such exclusive service. Some of these reasons follow:

(a) The providing of a less expensive service for such telephone subscribers as cannot afford the individual line service.

(b) The serving of a greater number of subscribers on a given size of line and switchboard equipment.

(c) The cutting down of the number of line terminals, appearing before each operator so as to facilitate the handling of the switchboard equipment.

(d) The providing of emergency capacity for the serving of additional telephone subscribers when the ultimate capacity of the line and switchboard equipment has been used and when additional line circuit material or central office apparatus is not immediately available.

It has been found from experience that a maximum of four subscribers can be served to advantage on one line circuit, when a non-interfering method of selectively ringing the subscribers' bells is provided. Of course some of the lines can be limited to only two subscribers so as to reduce the chance for interference between the telephone users on each of such lines and thereby provide a service of a higher class than the four-party line. In this case the equipment would be the same, the only difference being that the telephone company limits the number of instruments on a line to a total of two for two-party line service.

There are other limitations in the providing of a successful selective ringing system, such as the avoiding of ground returns for the ringing current and the avoiding of complicated mechanism in the sub-station instru-

ment, which would increase the first cost as well as the maintenance cost of the telephone.

HARMONIC SELECTIVE RINGING SYSTEM:—A selective party line system which meets all of these demands is known as the harmonic and now is extensively used throughout this country.

This system depends for its operation upon alternating currents of different frequencies. The ringers in the telephone are bridged directly across the line wires with

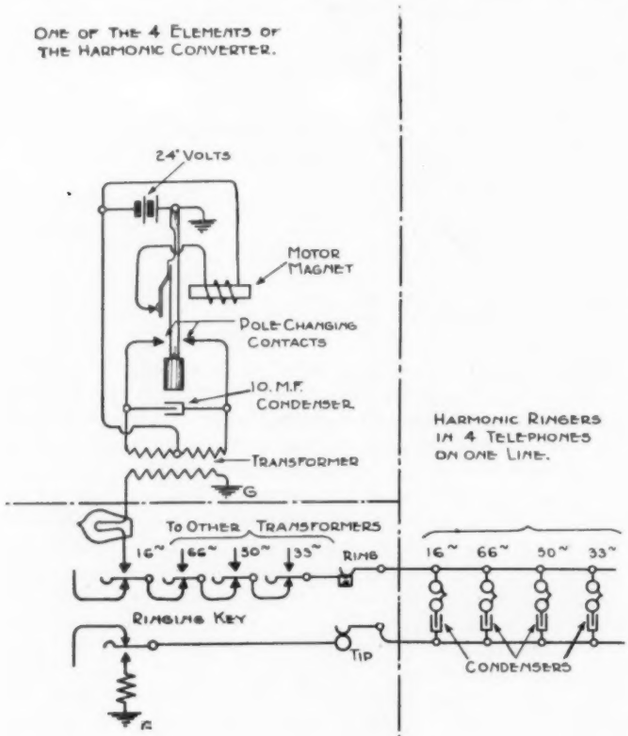


FIG. 5 - COMPLETE HARMONIC RINGING SYSTEM USING A HARMONIC CONVERTER TO SUPPLY THE FREQUENCY RINGING CURRENTS

the customary condenser in series to prevent the flow of central office battery when these instruments are used on the modern central energy systems. The armatures of these ringers are weighted or controlled in such a manner as to respond only to alternating currents of certain frequencies, this being accomplished as follows:

It is well known that a body having a certain period of vibration responds to this vibration more easily than to any other and often it is difficult to force the body to vibrate in any other than its natural period. A series of small impulses imposed upon a body, capable of vibration, will set this body in vibration providing the impulses be times to correspond to the period of the body. Also a small amount of energy applied at a little different interval from the period of the body will not cause it to take up its free movement.

Mr. Kempster B. Miller has given a simple example of this action in his book "American Telephone Practice" which is as follows: "A familiar example of this is found in one person pushing another in a swing. The swing has its natural period of vibration, depending on the length of the ropes, and a gentle push applied at proper intervals by the person on the ground will cause the swing to vibrate with considerable amplitude. If the pushes are applied at intervals not corresponding to the natural period of vibration of the swing, many of them tend to retard rather than help its vibrations, so that a useless bumping results, producing but little motion."

In the case of the telephone ringers, four different pendulums or armatures are provided, each having a different period of vibration which is controlled mainly by the different sizes of the metal balls placed upon the ends of the striker rods, used as tappers for the bells. It is necessary in this system that a source of alternating ringing current be provided which will give four different frequencies and also a suitable ringing key at the operator's switchboard for throwing any one of the four frequencies out to the line.

HARMONIC RINGING DYNAMO:—At first, the only commercial way to produce these four different frequencies was by mounting four armatures on a shaft with a governed motor, which was capable of running at a constant speed of 1000 revolutions per minute or 16⅔ revolutions per second. One of these armatures is placed between two pole pieces and hence furnishes a current of 16⅔ cycles per second. The second armature is placed between four pole pieces and since it has the speed of the first one it has double the frequency or 33⅓ cycles per second. The third armature has six poles and the fourth one eight poles and these furnish frequencies of 50 and 66⅔ cycles respectively.

It was in this way that the four frequencies of approximately 16, 33, 50 and 66 cycles per second, were selected and have since become standard for harmonic party line ringing.

The governing device used for maintaining the speed of the motor generator shaft at 1000 revolutions per minute is shown in Fig. 4. The driving motor is so designed as to run slightly under 1000 revolutions per minute. Then a non-inductive resistance is inserted in series with the motor field winding, so as to increase this speed to slightly above 1000 revolutions per minute. A centrifugally closed contact is arranged on the end of the

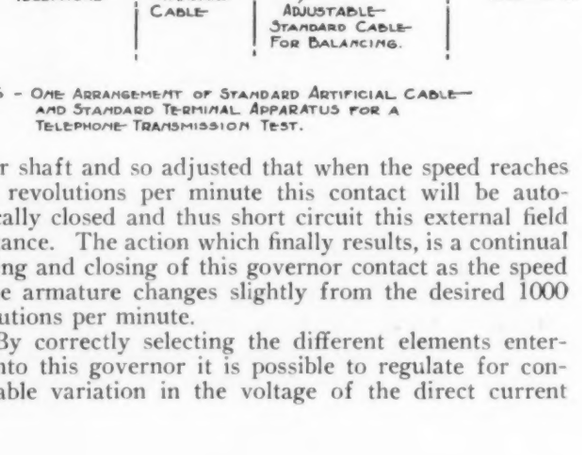


FIG. 6 - ONE ARRANGEMENT OF STANDARD ARTIFICIAL CABLE AND STANDARD TERMINAL APPARATUS FOR A TELEPHONE TRANSMISSION TEST.

motor shaft and so adjusted that when the speed reaches 1000 revolutions per minute this contact will be automatically closed and thus short circuit this external field resistance. The action which finally results, is a continual opening and closing of this governor contact as the speed of the armature changes slightly from the desired 1000 revolutions per minute.

By correctly selecting the different elements entering into this governor it is possible to regulate for considerable variation in the voltage of the direct current

circuit used for operating the motor as well as for the variations in the load imposed upon the various ringing generators.

HARMONIC RINGING CONVERTER:—The demand for a less expensive means for producing the four harmonic ringing currents and one which can be used in small exchanges where a suitable primary power is not available, led to the designing of a vibrating pole changer device which is known as the "Harmonic Converter." The upper portion of Fig. 5 shows the circuit arrangement of one element of the harmonic converted ringing equipment, the other three elements being the same, but arranged to vibrate at the three other frequencies. Each element is provided with a vibrating reed which is driven in the same manner as the armature of an ordinary vibrating door bell. These reeds are carefully designed and adjusted so as to work continuously night and day at a constant speed without the aid of any governing or compensating means. Contacts are provided on each reed so as to connect the battery current first through one half of the split primary of a transformer and then through the other half in the opposite direction. A condenser is used across the primary windings to prevent sparking at the contact points. The secondaries of these transformers go direct to the switchboard through the customary protecting lamp resistances.

The no-load power required by the harmonic converter when all four frequencies are in operation, but with no ringing current being used at the switchboard, is about 8 watts and it has been found from experience that these machines can safely handle a telephone switchboard serving over 6000 subscribers' lines. For larger exchanges or for heavy duty purposes, the switchboard ringing circuits are divided and each division served with a harmonic converter.

The small power consumption of the harmonic converter has made it possible to operate harmonic ringing equipment in small exchanges where outside electric current supply is not available or where the outside supply is irregular or unsatisfactory. In this case the direct current supply is through the use of ordinary dry cells or other primary battery.

IMPROVEMENTS IN SPEECH TRANSMISSION:—The improvements which has made it possible to conduct telephone conversations over longer distances apply to the refinement of small details in almost all of the apparatus entering into the so-called talking circuits.

The use of loading coils and the Audion type repeaters, has made commercial transmission over the extremely long distance aerial circuits and the trans-continental lines possible. Loading coils and vacuum tube repeaters also have made it possible to use the all-cable type of line for fairly long distance circuits.

Telephone lines are loaded by the insertion of impedance coils in series in the line wires and at sufficiently close intervals to avoid appreciable piling-up of the current and voltage waves (reflection losses) which results when there is much of a discontinuity in the circuit. The object of this loading is the balancing of the bad effects of the distributed capacity of the line by the impedance of the loading coils. When loading is properly applied the result is a great improvement in both the quality and volume of received transmission. On the other hand, if the loading is incorrectly applied or the line conditions are unstable, then the presence of the loading coils interfere with, rather than assist, the transmission.

TRANSMISSION STANDARDS:—Unfortunately there are no accepted standard instruments of precision yet devised for measuring articulate telephonic transmission. However, the work of producing such usable and reproducable standards for this purpose has been started by the United States Bureau of Standards. The present scheme of measurements is not only arbitrary but inaccurate, in that the transmitting and receiving terminal instruments are ordinary commercial transmitters and receivers. The erratic action of carbon, which is used as the resistance varying element in the commercial forms of transmitters, precludes any possibility of precise and reproducable results, when this type of instrument is used as a standard.

THE STANDARD CABLE:—There is one element in the present standard transmission testing circuit, which is accurately defined and which is commonly employed; that is the "Mile of Standard Cable." In this case the primary standard chosen was a certain No. 19 B. & S. gauge, non-loaded copper wire cable, having a mutual electro-static capacity of .054 microfarads per mile. The secondary standards of the cable, made up of resistances and condensers mounted in a box, now are in common use for transmission measuring purposes. It is customary for these artificial standard cable boxes to include the equivalent of 32 miles of the No. 19 gauge cable, for this has been taken as the longest line through which it is possible to obtain good commercial transmission, when the standard type of terminal circuit and apparatus is used.

HOW THE STANDARD CABLE IS USED:—Fig. 6 is an example of how the standard circuit and artificial standard cable is used in testing the transmission loss of repeating coils. The terminal apparatus here employed, at each end of the test circuit, is that regularly used with the standard cable. The fixed amount of line is a 16 mile section of artificial standard cable and is used to avoid transmission errors which can exist on a shorter length of test circuit. This amount of line also cuts down the volume of transmission to a degree where it is easily comparable.

Switching keys are arranged in this test circuit so as to connect the line, first through the coil under test and then quickly to connect an adjustable artificial standard cable, which is used for balancing purposes.

The actual testing is done by a person talking in one terminal instrument with a uniform tone of voice and with the mouth always at the same distance from the transmitter mouthpiece. This tester also does the switching, keeping the observer at the distant terminal instrument always in ignorance of the condition of the circuit. These precautions are necessary to avoid any error due to personal equation or opinion of the observer.

The balancing artificial standard cable is gradually added to the test circuit until the observer finds no difference in the volume of the transmission when the switch is in either position. Then the amount of balancing cable in circuit will represent a measure of the transmission equivalent of the coil under test. The result then can be expressed as a "certain number of miles of standard cable of loss."

It takes a trained observer to at once pick a difference in volume of transmission equivalent of less than one mile of standard cable. However, the average of a large number of tests will show the results in fractions of a mile of standard cable. The untrained observer, also, often mistakes a difference in quality for a difference in volume.

TRANSMISSION LOSS DUE TO INCORRECT USE OF TELEPHONE:—The use of the artificial standard cable

allows such losses as that due to the incorrect use of the telephone, to be expressed in terms which are easily comprehended by the regular telephone subscriber. For example, there has been determined from a series of carefully made tests, under a certain circuit condition, the equivalent value of the losses in transmission due to holding the mouth at varying distances from the transmitter of a particular telephone.

These results are given in tabular form below, expressed in terms of miles of standard cable and in the equivalent miles of non-loaded open wire line:

Distance of Mouth from Transmitter Mouthpiece	*Loss in Miles of Standard Cable*	*Loss Expressed in Miles of No. 10 B. & S. Copper Wire Line*
.5 inches	3.6 miles	45 miles
1.0 inches	11.0 miles	137 miles
1.5 inches	17.0 miles	213 miles
Limit of Commercial Transmission	32.0 miles	400 miles

Thus if the speaker's lips are held .5 of an inch away from the mouthpiece of this particular transmitter, the volume of the resulting transmission will be reduced an amount equivalent to talking through a No. 10 B. & S. gauge copper wire, non-loaded line, 45 miles longer than the actual intervening circuit.

Or we can express one of these results in another way: If the speaker's lips are held 1.5 inches away from the mouthpiece over 50 per cent of the available commercial transmission is lost, the limit being taken as 32 miles of standard cable.

Northern Pacific Adds Telephones

The Northern Pacific Railway is installing a telephone system for communication between headquarters of the Rocky Mountain division in Helena, Mont., and Livingston and points east, as well as Spokane and coast points. This will be effected the first of the year, according to T. E. Anderson, telegraph supervisor of the central division of the Northern Pacific Railway, with headquarters at Livingston. Mr. Anderson made arrangements in Missoula for the installation of switchboards, instruments and cables for use in the road's private system.

The necessity for instantaneous service in railway operation which is gradually increasing, has developed the need of telephone communication, it being recognized that the telephone outclasses the telegraph for quick service. In the past the telegraph was rapid enough, but continual progress has made it necessary to have both telephone and telegraph.

Though for the present the special private system will be established only over the central division, it is the ultimate intention to institute vocal communication between St. Paul and Tacoma. The present project calls for the connection of 42 stations by telephone.

Telephones on N. C. & St. L.

Operating N. C. & St. L. trains on the Paducah P. & M division by means of a private telephone system are the plans being formulated by railroad officials, who think that the ideas will be installed in Paducah offices in a very short while.

The telephone system of dispatching trains will not in any way interfere with the telegraph method, or the operators. No radical change will be made with the telegraph stations along the lines, as the telephone development, as heretofore."

will be affixed only as a matter of producing more efficient results.

For a number of years private telephone lines have been used to operate engines on the Nashville & Chattanooga division of the N. C. road. It has met with a decided success on railroad lines operating from Hollowrock Junction to Atlanta, Ga.

Merger Referendum for Dallas

After a conference with representatives of the Dallas, Tex., telephone companies Mayor Lawther announced that the proposed telephone merger franchise ordinance will be submitted to a referendum vote of the people at the April elections.

J. C. Casler, president of the Dallas Automatic Telephone Company, asserted that the telephone companies do not desire to merge and operate as one company unless the people of Dallas express approval of the plans. He suggested that the City Commission agree to submit the franchise to the people, asserting prior to the conference that he would make a fight to have the ordinance voted on by the taxpayers and telephone subscribers of the city.

Subsequent to the conference Mayor Lawther issued the following statement:

"At a conference between the mayor, Board of Commissioners and representatives of the two telephone companies, it was agreed that the proposed telephone merger franchise, when the final draft is completed and passed by the Board of Commissioners, shall be submitted to the people at the April election in 1918 for ratification or rejection."

Mr. Casler authorized the following interview:

"The telephone companies have been working faithfully for two years, in deference to popular demand for a merger, to work out plans which would make possible in Dallas a consolidated telephone development.

"From the date of the first conference on the subject with the Board of Commissioners, it has been the idea, both of the Board of Commissioners and of the telephone companies, that after the details had been worked out so that the grant could have the approval of the Board of Commissioners, it would be submitted to the people before taking effect if any public demand were expressed for such action.

"The board would not grant a franchise unless it was in accord with the wishes of the people.

"The companies do not want to merge their properties unless the public desires the merger.

"In view of the fact that some suggestion has been made that a vote at the April election is desirable, a conference was had between representatives of the companies and the Board of Commissioners, and it was unanimously agreed that the franchise should be submitted to vote of the people when it had been finally put in such form that it had the approval of the Board of Commissioners.

"A telephone development such as would exist in Dallas with the consolidated system would be unrivaled in the United States, but it entails difficulties and sacrifices on the part of both companies, and unless the public desires the merger after the situation is explained to it, the companies will cheerfully abide the will of the people and go on with their separate development, as heretofore."

Industrial Research

With Some Notes Concerning Its Scope In the Bell Telephone System

BY F. B. JEWETT

Major F. B. Jewett, S. O. R. C.

IT IS with a feeling half of diffidence and half of apology that I venture to present a paper on industrial research at this time to the members of this great engineering organization. The diffidence arises from the fact that for the past few years, and particularly since the outbreak of the great world war, the terms, the emblems and the forms of industrial research, if not always the realities, have been so much a part of the industrial daily life of the nation that the working of them together in a paper seems trite and somewhat of a reflection on the intelligence of the Institute membership. The feeling is akin to that which many of us have experienced when, after numerous courses in mathematics which have made its general processes seem rather second-nature to us, we begin the study of logic and find there a detailed explanatory discussion of these processes. The query at once arises as to why anyone should care to write about matters so obvious, let alone why anyone should waste his time in the reading and studying of such writings. Under these conditions it is clear that to be of interest and value any paper on industrial research should be most carefully thought out and worked over. My apology to the members of the Institute results from the conditions under which I have labored for the past four or five months. The calls upon my time and energies for war work have been so great as to make the careful preparation just referred to impossible. In other words, the doing of industrial research has, for the time being, shouldered out the thinking and writing about industrial research. What follows must therefore be read with the understanding that it is the hurried jotting down of ideas which have been scattered and relegated to the background by the ceaseless day by day pressure for the results of industrial research in the grim game of human destruction.

Much has been said and columns have been written on the wonderful achievements of industrial research in the past and on the stupendous effects which are to follow from industrial researches not yet undertaken. In fact, it seems to be the exception rather than the rule for a present day conversation to run its course without some reference to industrial research or its results. Under the circumstances it is sometimes surprising to find how little actual knowledge seems to exist as to what really constitutes industrial research or of the relations which it bears to research which is not industrial. On the other hand, we are frequently surprised by the evidences of real industrial research in hitherto unsuspected places. That industrial research has taken a firm place in shaping the destinies of the economic future, no one who is at all cognizant of the facts would for a moment deny. A partial picture of present conditions in the United States is interestingly shown in a recent paper entitled "Industrial Research in the United States of America" by Mr. A. P. M. Fleming, M. I. E. E.

As might be expected in a departure so radical and relatively so new, the processes of industrial research have not as yet been applied to the various arts in anything like a uniform manner. A survey of present day conditions in the United States discloses the greatest progress in and the greatest results from industrial research in large electrical, chemical and metallurgical industries, where real scientific research methods were first applied and where its application has been carried to the greatest extreme. The electrical industries have been particularly fortunate in this respect, due largely to the fact that they had no generation-long traditions to overcome and to the further and more important fact that a large proportion of the leaders have been men educated in technical schools and universities where the spirit of scientific research prevails. Under these conditions it is not strange that the value of industrial research should early have been recognized as a vital necessity in the electrical industries, nor that the methods of scientific research should have become so closely interwoven in all its processes. So effectually has this dependence on research methods been established in the larger electrical manufacturing organizations that no question is ever raised as to the proper method of attacking a problem or a difficulty. Not only do we look to the established research departments for the production of most of that which is radically new in the art but they have become and are, either directly or indirectly, our haven of succor when some particularly difficult and knotty problem arises. It is difficult for those of us who have lived and worked long in this environment to appreciate any attitude of mind but the one which seeks the answer to a radically new problem in the processes of scientific research. Thus far have we progressed from the era of the cut and try method—an era productive of much that was of inestimable value to the world. In comparing the present and prospective future with the past, we should also not lose sight of the fact that our so-called scientific methods would be of little avail were it not for the accumulation of facts laboriously dug out by empirical methods at a time when such methods were the only ones that could be applied.

While the development and beneficial results of industrial research are most apparent in the larger industries, where they were first applied and where funds have been available for a continuation of the work during the period when scientific methods were on trial, the signs are numerous which indicate the rapid extension of scientific research to the smaller industries. These signs are

*Presented at the 333d Meeting of the American Institute of Electrical Engineers, Philadelphia, Pa.

shown principally in the growth of industrial research laboratories established for the purpose of assisting clients with research facilities in much the same way that consulting engineers have long assisted in engineering matters; also in the formation of centralized research establishments destined to serve an association of individual manufacturers engaged in the same or similar lines of work. That this growth of industrial research will continue at an ever-increasing rate seems beyond question. The results thus far obtained leave no doubt as to the value of scientific methods when applied to industry and the truth of these results is becoming each day more clearly evident to the rank and file of those engaged in the production of material things. The process of this evolution of thought and application is well illustrated by Macauley in his "Science of Government," where he says, "First come hints, then fragments of systems, then defective systems. The sound opinion, held for a time by one bold speculator, becomes the opinion of a small minority, of a strong majority, of the majority of mankind. Thus the great progress goes on."

That the great war on which we are embarked is exerting an enormous, stimulating influence on the extension of industrial research is clearly evident. The limits, both in time and extent, seem now to be determined merely by the ability to obtain specially trained men and women and the ability of the present industries and their workers to absorb properly the serum of the new inoculation. While very great benefits will undoubtedly accrue from this extension of scientific research methods into the arts and industries where it has not hitherto penetrated, very grave dangers undoubtedly attend the present forced growth. These dangers are two-fold in character. In the first place, with the enormous demand for research workers and with the glowing prospects of hitherto undreamed of accomplishments, many men will undoubtedly undertake so-called research work for which they are essentially unfitted, both as to mentality and training. At the same time, alleged research activities will be started on a large scale in places where there is little or no present call for such activities or where the nature of the problems is such as to necessitate a gradual building up of the research function. These two correlated factors, which are not at all unique to industrial research, since they in one way or another attend the publication of every new and useful achievement, will undoubtedly result in temporary reactions against the scientific method and in favor of the so-called "practical method." The extent to which these reactions will prove deleterious to the general early extension of scientific methods of the various industries will depend very largely on the control and guidance which is exercised in the next few years and in the ability of our universities and technical schools to meet the large demands for capable, scientifically trained men which will be thrust upon them.

This brings us to the second of the dangers, namely, the possibility that the pressure of industrial research may react on universities and technical schools in such a way as to cripple them in their essential functions as a part of the general scheme of national economic development. In the chaos attendant upon the growth and development of this new element of our industrial fabric there has been a great deal of uncertainty as to the relations between so-called "pure" and industrial researches and the relation of the university to the industrial research laboratory and its problems. A part of this chaotic condition is inherent in the nature of a situation which requires much experimentation before the road to the answer is clearly marked out. A part, however, is undoubtedly due to failure properly to analyze the situation and assign to each element in the research program its real sphere of utility.

The relations between pure and industrial research and between the university laboratory and the industrial laboratory were very fully considered and very clearly set forth by Colonel J. J. Carty in his presidential address at the annual meeting of this institute in Cleveland in 1916. Colonel Carty pointed out that much of the confusion now existing was due to the fact that the *methods* employed in pure or academic research and industrial research were identical and that from this had arisen a confusion of ideas based on the assumption that identity or lack of identity in the method was the yard-stick by which research was to be designated as pure or industrial. Colonel Carty pointed out that the real distinction lay in the motive behind the research and not at all in the methods employed. In other words, two investigators starting from essentially the same basis of fact and pursuing practically identical paths to practically identical conclusions could be, the one a performer of industrial research with a purely utilitarian motive, and the other a delver in pure research for the purpose of enlarging the bounds of human knowledge and with no immediate utilitarian aim in view.

If, as Colonel Carty points out, the question of motive is the essential determining factor which differentiates pure and industrial research, a thorough appreciation of this fact should tend to clarify the situation as concerns the functions of academic institutions and their research laboratories in the industrial research problem.

Viewed from the standpoint of motive, there would appear to be but little place in an academic institution or its laboratories for real industrial research. Per contra, there would appear to be but little place for so-called "pure" research in a strictly industrial organization. It does not necessarily follow from this that an academic institution should engage in no industrial research, nor that an industrial institution should never undertake problems of pure research, for, on the one hand a certain direct and limited participation in industrial research may be the best way to advance pure scientific research and the development of men, while on the other hand, limited excursions into the realms of pure science may react to the best interests of the industrial laboratory and its staff and be productive of real and worthwhile extensions of the realm of knowledge. In such cases, however, there should be no misunderstanding as to the governing motives.

Viewed in the broadest possible way and considered as a part of a complete national organization, industrial and academic or pure science research laboratories are, of necessity, very closely associated and must grow together and with the same relative vigor if the best interests of civilization are to be served. It is difficult to see how either could completely supplant the functions of the other. On the one hand, the academic institution, with its pure research laboratories, is engaged primarily in the education and development of men trained in scientific methods and in extending the realms of knowledge for the benefit of mankind and without any particular utilitarian motive. On the other hand, the industrial research organization is engaged primarily in the utilization of trained scientists for the solution of utilitarian problems; in other words, in the cultivation of the regions discovered and mapped out by the experimenters in pure science. The industrial research organization is not a general educational institution and from its very nature cannot take over that function of the university and tech-

nical school which has to do with the fundamental training of men. Further, since it is part and parcel of an institution, whose primary object is avowedly commercial production for the sake of monetary gain, and all of whose funds are derived from the sale of its wares, it cannot usurp in any large measure the functions of the university or the pure science research foundation without raising a grave question of ethics involving the body politic.

If, therefore, the university and technical school are primarily what we have long considered them to be, namely, institutions for the training of men and for the carrying on of researches designed to enlarge the bounds of knowledge, and if, on the other hand, industrial research organizations are institutions which utilize the human product and the advances of the universities in utilitarian adaptations, it follows that there is and can be no serious competition between the two, for, on the one hand, if the university or technical school should attempt to enter too largely into the realm of industrial research it would run the very grave risk of destroying its primary functions by the establishment of an atmosphere highly prejudicial to the broad training of men or to pure scientific research. On the other hand, the industrial research organization is not equipped to undertake the general work of the university either in the training of men or the conducting of pure research, nor can it afford to do so. From the very nature of its genesis, the utilitarian object is the motive controlling it. To be sure, occasional pieces of pure scientific research may from time to time emerge from the industrial laboratory, but this work will be small in comparison with the sum total of accomplishment in its proper field.

But to succeed in its proper field industrial research must receive a continual stream of capable men and women thoroughly trained in methods of scientific research, thoroughly grounded as to the geography of knowledge, and competent to appreciate any extensions in its boundaries and capable of immediately cultivating such extensions for the benefit of the particular industrial research organization with which they are connected. Any failure in the supply of men or any failure to advance the bounds of knowledge by pure scientific research will result inevitably in a strict limitation of industrial research. In referring to the work of the early chemists and alchemists, Sir William Tinney remarks that until men began to observe and interrogate nature for the sake of learning her ways and without concentrating their attention on the expectation of useful applications of such knowledge, little or no progress was made. In other words, until a sufficient foundation of pure science has been successfully laid there can be no applied science.

In considering the part which the educational institutions should play in the solution of research problems for industrial organizations, there are other factors which should not be lost sight of. As already indicated, there would appear to be a very real and imminent danger to its pure research function if the educational institution were to embark largely on the solution of industrial problems for commercial organizations. Such a course would establish an attempt to maintain in the same institution two sets of research activities impelled by antipodal motives. On the one hand would be the group of pure scientific investigators, whose impelling motive was the desire to explore unknown regions and extend the bounds of knowledge without any thought of the immediate practical application of the results of their work. The measure of their achievements would be the number and extent of the new facts brought to light. On the other hand, the industrial research group would be involved solely in the practical results of their work and the measure of their success would be an amount of money made or saved.

This state of affairs, involving the existence in the same institution of two groups using the same methods but impelled by different motives, would not itself be serious if the financial situation of the individual workers was relatively the same. Unfortunately, this is never the case. Having a monetary motive, success in industrial research is measured largely by a monetary reward and there would be, therefore, a strong tendency for industrial research workers in the educational institution to command and obtain larger emoluments than their confreres in the pure research field. Since academic salaries are, in the main, notoriously low, any scheme which would raise the general income of the industrial research worker above that of his co-worker in the pure research field would produce dissatisfaction and discontent and what is worse, a tendency for the major part of research ability to gravitate into the industrial field. Occasional exceptional instances of men so imbued with the love of scientific research that the question of monetary return is wholly secondary cannot outweigh the fact that in the great majority of cases the needs of life and family for the material necessities and comforts of life are a far stronger force in determining a man's actions than any other.

There is another factor of quite a different character which must be reckoned with. This is the element of human nature in man as at present constituted and as exemplified in the legal rules which he has evolved for the proper guidance of his affairs. Roughly speaking, in the material aspects of life human beings expect to enjoy for a time at least, the exclusive results of their efforts. This is certainly true in the realm of industrial research where those who advance money for its promotion expect to enjoy the proceeds which flow from its results. This is neither an unnatural nor an unworthy aspiration, but it does raise a considerable question as to the policy of an educational and pure research institution entering upon a relation with the providers of funds which would tend to limit definitely the freedom of the institution in certain directions. For centuries early and full publication of the results of scientific research has been a cherished prerogative of the research worker and of the institution with which he was connected. If the institution is now to enter into a commercial relation with individuals and groups whereby it is to undertake the solution of their problems with the help of funds which they provide, it must expect to be governed to a large extent by the rules which govern in the commercial field. Not the least of these rules is the one which ordains that the results of industrial research shall be the exclusive property of those who accomplish it, either by being maintained in secret or by being protected by patent.

The welfare of the university and the technical school in their proper functions should therefore be a matter of the gravest concern to all who are engaged or interested in industrial research and we should be continually on the alert to see that their facilities are ample and functioning to full efficiency. From the standpoint of the writer, these facilities should be mainly those which will enable them to attack broadly problems of fundamental scientific research—the facilities for industrial research being provided either by the individual industries themselves, by associations of manufacturers, or through the medium of industrial research laboratories equipped to undertake the solution of problems for clients. While

these latter would, of course, be self-sustaining, they would not necessarily be money-making institutions in the ordinary sense.

The second of the dangers of the present situation referred to above is that under the enormous pressure for industrial research, engendered by war conditions, too large a proportion of the men capable of pure scientific research and the instruction of other men may be drawn away from their proper field of endeavor. If this withdrawal is but temporary and for the duration of the war, no great harm will probably result. If, on the other hand, there is danger that the withdrawals will be permanent, the results for the next decade will be serious indeed, since we will have erected the skeletons of huge industrial research organizations and find ourselves confronted with an inadequate supply of properly trained men to carry on the work. Further, there will be a long continued cessation of explorations in those regions where exploration is most needed. For the good of the nation no stone should therefore be left unturned to provide suitable research facilities in a suitable research environment for every man who shows that he has that element of originality, without which progress is impossible.

From what has been written in the foregoing paragraphs it occurs to me that I may possibly have trenched too largely on the scope of the papers to be covered by Mr. Skinner and Professor Kennelly. If so, my excuse is that I have not had opportunity to consult with them and also that it is difficult for me to set forth my idea on industrial research without, at the same time, stating my viewpoint on the relations of industrial to pure or institutional research. Further, as my point of view may not be identical with that of the other writers, some useful purpose may be served by its presentation.

Having set forth certain conditions which seem to me fundamental and certain situations which appear to confront all of us who are interested in the progress of industrial research, it may not be uninteresting to outline briefly the scope and progress of industrial research in the Bell Telephone System.

The aim of this research is frankly utilitarian in character. The main and never-lost-sight-of aim of the work is the advancement of intelligence communication telephonically and telegraphically by the application of the best scientific methods to the solution of the innumerable problems which arise. In the present stage of development the arteries of industrial research permeate a very large part of the organization. This considerable utilization of scientific research methods is not the result of a mushroom growth but is a gradual evolution through the experience of many years. All of this experience has tended to confirm our conclusions that real advances in the art of telephony and telegraphy are to be looked for only in the results of broad-minded and painstaking research work. For many years, therefore, the constant effort has been to provide an ample staff of capable men, specially trained in scientific methods, and to place at the disposal of this staff whatever was necessary in the way of material facilities or human assistance. In common with many other industries engaged in the development of industrial research, the principal difficulty that has been experienced has been the securing of a sufficient number of trained workers. While not necessarily a reflection on the colleges, universities and technical schools, since their problem was a huge one, it is undoubtedly true that they have not in the past been able to secure, train and supply a sufficient number of skilled men and women to meet the evergrowing demands of industrial research. The result is that we of the Bell Telephone System are today confronted with a very large number of problems of the utmost importance in the advancement of national and international communication work, and it is only through the greatest exertions that we have been able to secure and organize the specially trained force needed for their solution.

A common and not unnatural mistake concerning industrial research is that its field is limited very largely to the solution of laboratory problems. I venture to say that if a hundred educated and intelligent people in the ordinary pursuits of life were asked their ideas as to what constituted industrial research the great majority of them would picture some sort of a building or buildings in which men were experimenting with bottles and glasses and chemicals or with mechanical or electrical instruments of some sort. Although the work which goes on in laboratories such as these is a vital and essential part of the industrial research problem, it is by no means the whole of its sum and substance. In order to make the work of the laboratory investigator of maximum efficiency it is necessary in some way or other to formulate the requirements of his problems so that he may direct his energies along the straightest path to the desired goal. In many cases it is further necessary in some way to investigate carefully the products of laboratory work from the standpoint of their adaptability to commercial requirements and to the re-actions which they may bring about in more or less unexpected places. All of this follows directly from the fact frequently lost sight of, that what should be done depends in large measure on what can be done, and what can be done in turn on what it is essential to do. In other words, it is the old problem of the gun, the projectile and the armor in a slightly modified form. While a little thought indicates the necessity for a proper correlation between a study of requirements, the formulation of the problems to be solved, the carrying on of the research, and a test of its results in their practical application, it is clear that no hard and fast scheme of organization, applicable alike to all industries, can be laid down. In fact, it seems that the proper methods are almost as numerous as the types of industry to be served and that they range from a condition, on the one hand, where the entire problem is undertaken by the man who actually performs the research to the other extreme, where each phase of the problem is in the hands of separate individuals, no one of whom encroaches in the slightest degree upon the field of his co-worker.

As exemplified in the Bell Telephone System, the carrying on of industrial research does not lie at either of the above extremes, although possibly it may approach slightly nearer to the latter than the former condition.

Broadly speaking, the organization of our industrial research can be divided into two main subdivisions:

1. That part which is performed in the central engineering department of the American Telephone and Telegraph Company; and

2. That part which is performed in the centralized laboratories of the Western Electric Company.

In the first of these two divisions originate many of the requirements which call for the application of industrial research. This group, which constitutes in a way the central research department of the Bell System, is under the immediate direction of the chief engineer of the American Telephone and Telegraph Company, who has likewise general direction of the research problems undertaken by the second of the groups. The equipment of this group consists not of laboratories and apparatus but

of highly trained human beings, the whole forming an organization capable of passing expert judgment on any of the vast number of problems continually arising in the System. In this central analytical research department are conducted not only the studies tending to correlate the requirements for the specific research work needed by the Bell companies, but also those broader studies of fundamental requirements of growth in an ever-expanding electrical intelligence communication system. The necessity for a group of this kind, equipped in the manner indicated, is the result of our years of experience with other and what now appear to be essentially faulty alternatives.

From this first division of the research organization originate in large measure the sailing directions which govern the course of the physical and chemical researches carried on in the centralized laboratories of the Western Electric Company. Without these sailing directions it would be impossible to carry on much of the work of the centralized laboratories, which is now productive of results of great value. Before passing to an outline of the work of this second division, there is one point which should be clearly understood. This is the fact that while the research work of the Bell System is divided into the two main and essentially non-overlapping divisions noted above, it is not to be understood that the work of each of these divisions is carried on wholly independently of that of the other. Each group is in constant and direct communication with the other group and there is nothing of the idea of a separate cell organization in the arrangement. In other words, there is no thought that the work in the first division will be entirely completed without consultation with those in the second division, or that of the second division without consultations with those in the first division. For example, in the formulation by engineers of the first division of a problem to be investigated in the physical or chemical research laboratories, the research men of these laboratories are drawn into the work in a preliminary way to avoid, so far as possible, any chance of such formulation as would result negatively or involve a large expenditure of time and money in essentially useless work. Very frequently this preliminary participation of the laboratory research workers modifies the requirements which were originally thought proper.

As indicated above, the physical, chemical and mechanical research laboratories of the entire Bell System are centralized in the Western Electric Company and are under the immediate direction of its chief engineer. This centralization of laboratory facilities was adopted after a number of years' trial of other arrangements, involving at one time three large separate laboratories. The experience of the past ten years has indicated clearly the desirability of the present arrangement in the system as now constituted. First and foremost, it makes available an extent of plant and staff not otherwise economically possible. It also tends to a more efficient utilization of this plant and staff on the major problems of the System by eliminating practically all duplication of effort, which previous experience indicated to be inevitable in a non-centralized laboratory organization. Finally, and not by any means least in importance, is the material advantage of having the research laboratories closely associated with the manufacturing part of the System. This advantage is the direct consequence of the fact that practically all of the results of our research work find their immediate fruition in physical apparatus which is to be constructed in large quantities under modern manufacturing methods. Any failure, therefore, to co-ordinate closely the work of the industrial research department with that of the manufacturing department would result in considerable delays and inconveniences and great monetary loss.

For purposes of administration and the more efficient carrying on of the work, the laboratory is divided loosely into a number of principal divisions, each concerned with some general phase of the industrial research problems peculiar to the telephone and telegraph industry. Thus we have the chemical laboratory, dealing with the class of problems its name indicates; the transmission laboratory, dealing with those researches which are peculiarly involved with telephone transmitters, receivers and the efficient transmission of speech and telegraph currents; the fundamental physical research laboratory, which deals with the broader physical problems of the industry; the general physical laboratory, which deals with the more specific and immediate problems; the manual and machine switching circuit laboratories, which deal with those problems peculiar to the complicated networks which form such an integral part of modern communication systems; and finally, the various telegraph, mechanical and metallurgical laboratories, which deal with specific problems in other spheres of the work. All of these various laboratories are organized to work in the closest harmony and without unnecessary duplication. Very frequently the solution of some research problem involves the co-operation of three or four of the groups, each group handling the particular element of the problem for which its personnel and equipment particularly adapts it. Very frequently also problems arise which necessitate the formation of a special group selected from the various parts of the organization, with particular reference to the work in hand—this group being disbanded on the completion, or re-organized as the work progresses.

As indicated above, the laboratories of the Western Electric Company handle the physical, chemical and mechanical researches for the entire Bell System. In large measure these problems are those formulated as a result of the analytical researches of the first group noted above, namely, that under the immediate supervision of the chief engineer of the system. In the carrying on of this work with a staff of expert research investigators, many collateral problems arise. These problems, after preliminary investigation, are discussed with and studied by the members of the first group and if found to be of essential value in the art of communication they are put in the way of full and proper solution.

In conclusion, and judging the future by the evidence of the recent past, it seems clear that our industrial research problems are destined to grow enormously, provided an adequate supply of capable and highly trained investigators can be secured. This, and this alone, seems to mark the only practical limitation to the size of our research organization, since experience has shown that where the proper type of trained mind can be applied the financial results invariably return many times the cost of the research. To secure the necessary men, those charged with the direction of industrial research must look to the universities and higher technical schools. We must see that in our zeal to obtain immediate results we do not jeopardize our future by taking from the institutions the instructors and research men who can be of more service to the industries of the countries in their academic pursuits than they could be in industrial occupations.

The Marvel of the Telephone

Paper Presented at the 1917 Meeting of the New Mexico Electrical Association

BY J. F. GREENAWALT

THE telephone is surrounded by such an atmosphere of mystery and possesses such marvelous powers that it inspires in me a feeling approaching reverence. The tremendous influence which the little instrument has upon human activity fascinates me and holds me in its spell. How does it gather up the sound of my voice, transmit it in silence to a distant point, and there faithfully reproduce it with every accent, every inflection complete? I don't know. The inventor himself doesn't know. Can anything be more mystifying? I place my lips close to a thin metal disc and speak. The metal disc vibrates. An electric current picks up the vibrations and carries them across the city or across the continent, and my friend hears and understands. My part in the operation is simple, my friend's part is not complex, but the part played by the metal disc and the electric current has never yet been written. Mysterious, wonder-working, fascinating it is, and today wholly indispensable in business.

The story of the birth of the telephone in 1876 and its development from a crude contrivance, generally regarded as a toy for the pastime of the rich, into an actual commercial, household and social necessity, reads like a romance as alluring and as wonderful as a chapter out of the Arabian Nights entertainment.

After years of experimentation, during which time he was often hard pressed for funds sufficient to keep him supplied with food, Alexander Graham Bell succeeded in transmitting the sound of the human voice over a wire. It was on March 10, 1876, that the telephone first talked, and it has been talking ever since.

But no child of an inventor's brain ever had a more desperate struggle for existence, and no inventor ever experienced darker days. For eleven years after the telephone first spoke, Bell and his few loyal friends who believed in him and had faith in his invention, endured poverty, struggles, discouragement, ridicule, court wars and battles for commercial recognition. At first scientists were interested only as it presented a new problem for the laboratory; newspapers condemned it; the public made fun of it; the commercial world derided it; and business men would have none of it. Gradually, however, the utility of the telephone intruded itself upon the consciousness of the commercial world, and its popularity grew by leaps and bounds.

It is interesting to note how apparently trifling circumstances sometimes develop into powerful factors in important events; and to note, too, how, often it is wise to act upon a woman's intuition. Bell's experience was a case in point. At the time he was making his experiments, Bell was conducting a "School of Vocal Physiology" in Boston. This was a school for deaf mutes whom he taught what he called "visible speech." One of his pupils was Mabel Hubbard, daughter of Gardiner G. Hubbard, the latter becoming Bell's chief supporter. The teacher lost his heart to this gentle, lovable girl, and some years afterward she became his wife.

Meanwhile, just two months after the telephone had spoken its first word, the Centennial Exposition at Philadelphia was opened. By a fortunate chance Hubbard was one of the Centennial commissioners, and by his influence a small table was placed in the department of education in a narrow space between a stairway and a wall, and here was deposited the first telephone. Bell had no intention of visiting the exposition. He was too poor. He had neither railway fare nor money for hotel bills. But one afternoon his sweetheart was taking the train for Philadelphia. Bell accompanied her to the depot to say goodbye. Here Miss Hubbard learned for the first time that he was not to go. She coaxed, pleaded and wheedled, and finally insisting that for his own sake he must look after his exhibit, she burst into a passion and tears. That settled the question. Bell sprang aboard the moving train and Miss Hubbard loaned him the money for the trip.

This was on Friday. The following Sunday the judges were to examine the exhibits in the educational section. All day Bell waited to demonstrate the telephone. Nearer and nearer came the judges, as the shadows lengthened into the late afternoon. The day was depressingly warm, and just before reaching the corner where the telephone was located, the judges declared they were tired out and would stop the examination for the day. Bell's heart sank and he grew ill with disappointment. But just at this juncture there was a stir in the educational section, Dom Pedro, emperor of Brazil, accompanied by the empress, was examining the exhibits. The judges fawned in the presence of royalty. Suddenly the emperor espied the young inventor seated by the little table in the corner. There was a look of recognition and Dom Pedro hurried to Bell with a cordial greeting. Immediately the attitude of the judges changed. Who was this young man who claimed the friendship of kings? Bell explained his invention. Dom Pedro was interested and insisted on trying it. A spool of wire was unwound and one instrument was taken to a far room in the building. Bell talked and the emperor heard. The judges talked and listened, while all were fascinated. They forgot the heat—forgot they were tired and hungry and it was not until after 7 o'clock in the evening that the emperor went on his way and the judges ended their tests. The next morning's papers quoted the judges as saying the telephone was the greatest invention of the great exposition.

Three years before Dom Pedro had visited Bell's school for deaf mutes and had been much interested. Who can say how much the time of recognition of the telephone was advanced by the act of the young woman in insisting that Bell must go to the exposition, and by the happy circumstance of the emperor's propitious visit? Certainly it was a happy combination of events.

Notwithstanding the possibility of transmitting the human voice was now an established fact, there followed another long period of struggle for commercial recognition. Even those who talked over the telephone and listened to the sounds of their friends' voices were skeptical. They suspected a trick. To the scientist and to the laborer alike the thing was incomprehensible. One mechanic insisted that the wire must be hollow. Editors ridiculed the idea of its having any usefulness. The banker said it might do very well for a grocery store but it would never do for a bank. On the other hand, the grocer agreed that it might work in a bank, but it would

be useless in a store. Bell alone had sufficient imagination to picture the telephone in general use in the business world. But to all it gave a sort of gruesome feeling. The idea of talking against a disc of metal made them feel foolish, and the fact that the voice could be heard the distance of a city block brought the suspicion that in some way it must be allied with the powers of darkness.

But Bell was persistent. Others became interested. Problems one by one were solved. The switchboard was evolved. Two wires instead of one were found to remove induction. It was discovered that copper would give better transmission than iron, but it was too soft and could not be strung taut enough. Out of this grew the invention of hard-drawn copper wire, one of the most valuable contributions to the science of telephony. And there was born the long distance telephone line, which today is accepted in the most blase manner, as though it had appeared during the first six days and been pronounced good with the balance of creation.

So much for the early days of telephony. Not a decade has passed since its invention that has not witnessed a complete revolution in equipment and methods —not a year has passed that has not marked increased efficiency in the service. But the story is too long.

Today the telephone is so thoroughly woven into the warp and woof of commercial and social life that it would be difficult for the present generation to imagine an existence without this means of communication.

That the telephone is an important factor in business efficiency really admits of no argument. The broader statement may be made that the telephone has increased human efficiency in every channel through which human energy is directed. It has multiplied man's capacity for work and has extended his every faculty far beyond the circle which formerly circumscribed human effort. And this efficiency comes through binding people and communities together in a co-ordinated mass, making possible a co-operation such as was impossible before the advent of the telephone. Without means of instant communication, co-operation is impossible. Someone has said that those inventions which have bridged distances have done most for the human race. The telephone does even more than bridge distances—it absolutely annihilates space. It converts a state into a neighborhood, and a city becomes a household.

As an example of how closely the people of a state are united by telephone, let me recite an instance: At the time of the great San Francisco disaster, the governor of Massachusetts wished to secure the co-operation of the mayors of the different municipalities in the state in raising a relief fund for the sufferers. The Bell lines were placed at his command. In less than five hours the governor had gotten in touch with the more than 350 mayors and had them working along the lines which he suggested. Such instant co-operation between the people of a state would have been absolutely impossible before the advent of the telephone. Remember that the people of Kentucky waited three weeks before they heard that Madison was elected president.

The great slogan of the American people, and especially of the people of the West is "Do it now." The telephone enables us to live up to that motto.

Ian McLaren says, "No American goes slow if he has a chance of going fast. He doesn't stop to talk if he can talk walking, and he doesn't walk if he can ride." And the canny Scot might have added that in business affairs he neither walks nor rides—he telephones.

Today the man of important and varied interests accomplishes more in a day than his grandfather did in a fortnight. The reason for this is obvious. The grandfather depended upon a very incomplete telegraph system, the slow operation of the postal service, long railroad trips, and the then ubiquitous messenger boy. Today the telephone brings his business associates, his clients or patrons and prospective clients or patrons to the business man's elbow. If a question arises that requires the opinion of another, whether he be a block or a mile or two thousand miles distant, he returns to the telephone and the matter is settled at once.

Is there any question in the matter of bonds, coupons or financial matters of whatever character, the banker employs the telephone. And only forty years ago the banker scorned the idea of using the telephone on business conducted with so much secrecy. The telephone contributes largely to banking efficiency.

The grocer of today without a telephone could no more compete with others in his line than could an expressman driving oxen compete with the motor truck. No more order men going from door to door looking to customers' demands. The man at the telephone does the work of a half dozen men in carts or on bicycles. And yet it isn't so long ago that grocers said the telephone could never be of any use to them. It is safe to say that not a single business transaction is completed today without the use of the telephone entering into it in some way or other. It contributed infinitely to the efficiency of the engineers and superintendents in the building of the Panama Canal. Railroads have adopted it for the dispatching of their trains. At the larger terminals you will find a telephone in the observation car of every first-class train, which is connected up until the moment the train pulls out. The same thing is true in respect to steamships preparing to leave port. The large mines are all equipped with telephone lines connecting the superintendent's office, the shops, the ore houses and the underground workings. From the lowest level of the mine the superintendent can discuss questions that arise with the mine president in a distant city. Likewise the bonanza farmer of the northwest employs the telephone to direct the work of plowing, planting and harvesting his thousands of acres. And by the same token it contributes to the success of the modest market gardener, for it enables him to keep in constant touch with the commission men—there is no more guesswork as to what his morning load should contain. He calls up and knows what is required.

The late E. H. Harriman was noted as a telephone user. It is said of him that on one occasion he raised a hundred million dollars in twenty minutes by using the telephone and saved the Erie railroad. He had a telephone in every room of his palatial residence, including his private bathroom. Some one said to him, "You let the telephone make a slave of you." He replied, "No, I make a slave of the telephone."

When an accident occurs, the telephone becomes the first aid. In time of sickness the telephone keeps the doctor in touch with the case, and keeps anxious friends advised. It is the best guardian of the home. Night prowlers stand in awe of its powers. In case of fire or other disaster the telephone is the silent messenger that summons assistance. In the affairs of the heart it is a boon to lovers, and I must admit, in some such cases, it is also the despair of fond parents. It makes and breaks social engagements. It orders the groceries, does the shopping, conveys holiday greetings, and speaks words of comfort to bleeding hearts. It is found in every portion of the globe, from the frozen shores of Labrador to the South Sea Islands, and even in the darkest jungles of

Africa. It speaks all languages from Bowery slang to Nipponese.

So intimately has the telephone insinuated itself into the very lives of the people, especially the lives of the American people, that any general cessation of the service or any general impairment of the service would be nothing less than a calamity.

In this connection, may I touch upon a matter that has to do with the public's share in the responsibility with the telephone company in giving adequate and efficient service? The public is interested in the quality of service and fairness of rates. The one question uppermost in the telephone user's mind is: Is the service as good as the company can give and are the rates as low as they ought to be? The average telephone user never asks the question: Are the rates which we pay sufficiently high to enable the company to maintain its plant at a high standard of efficiency, to pay salaries and wages high enough to attract men and women of superior ability, to maintain a proper reserve for deterioration and obsolescence, and in addition, to pay a fair return to the men and women who have invested their money in the business? And if one stops to think about it, the answer to the second question is the answer to the first. For it must be obvious that if the plant and equipment is not properly maintained the service must necessarily suffer; and if the employes are under paid the able and ambitious will seek other fields, leaving the service at the mercy of the less efficient; cheap labor never makes for excellence of a product; and if no provision is made for a fund to take care of the depreciation the plant will some day fall into decay and there will be no means to rebuild it. And in addition to all of these, if there are not sufficient revenues to pay a fair return upon the investment capital will not be attracted, expansion will be impossible, no new plant can be built and eventually the service will be limited to certain circumscribed areas. This all gives a glimpse of a condition far from the ideal.

Whenever the people through their representatives arbitrarily force rates upon any public utility that are not adequate to meet the requirements which I have just outlined, the people themselves will eventually be forced to put up with a service far below the standard; such action renders the utility corporation helpless to give the highest class of service to which under fair rates the public would be entitled.

There was a time, and it was not so very long ago, that public utilities were promoted for the benefit of the promoter alone; generally the stock found its way into the hands of innocent purchasers, and the new owners found themselves confronted with the problem of paying dividends upon large issues of watered stock and generally with an inferior plant with which to make such dividends. That method is now very much out of fashion; and those utilities which were not inclined to voluntarily put their business upon an honest basis have been forced to do so by federal and state regulating bodies which have been created during the past few years. The public, however, has not been chastened to this extent. The fact should not be lost sight of that the public is just as susceptible of wrong notions and of wrong impulses as is any individual, but with no individual responsibility or conscience. It is undoubtedly true that the general public is gradually throwing off its prejudice and suspicion, growing out of misinformation or lack of information concerning large corporations. Corporations are more inclined to inform the public on all matters affecting relations between themselves and the public. Corporations are also more than ever before injecting the human element into the administration of their affairs. They are coming to the realization that merit is a surer and more reliable safeguard to their interests than is political influence. On the whole, the corporations and the people are getting closer together; the public is beginning to realize that there is such a thing as corporation character, and that a corporation can have ideals as well as can the individual. For instance, the corporation which I represent has ideals of construction standards; ideals of service efficiency; and ideals of duty to the public. In many ways we fall short of realizing the ideal, just as individuals fail to live up to the standards which they have set up for themselves.

Telephone Man Talks on War

Saturday night, November 24, the Scotchmen of Troy, N. Y., and vicinity enjoyed a war story with stereoptican illustrations, that was given for the first time in Troy. The talk was entitled "The Telephone in the World War," the speaker being Ralph Haver, local manager of the New York Telephone Company.

The Troy Burns club is noted for interesting monthly gatherings, but that of Saturday night was one of more than usual interest, not only on account of pictures showing the British development of the telephone in its drives against the Germans in Flanders, but also the fact that the telephone was the invention of a Scotchman, Alexander Graham Bell.

The story, as told by Mr. Haver, was interesting. First of all the use of the telephone during the Mexican border crisis was shown, and how the American troops were able to protect large territories with comparatively few soldiers by means of the splendid system of telephone communication.

The British telephone system in France was next shown. Starting from the British war office in London pictures gave a splendid idea of what Great Britain has done in the telephone business. Mr. Haver explained that when the great British tanks started out on a drive they did not proceed in a haphazard manner, but every tank is controlled by telephonic communication with the headquarters or signal service.

The telephones in the trenches and outposts were depicted on the screen and it was conceded by those present that few have any idea of the immense task of the British and French in maintaining their signal and telephone services.

The use of the telephone for range finding for the artillery was shown. The danger, discomforts and intelligence of the signal corps of the armies in the western front were illustrated. Pictures were also shown of the systems of Italy, Germany, Austria and Russia.

The concluding pictures were those of America, showing the wonderful work of the United States signal corps service. When the United States soldiers arrived in France one of the officers desired to communicate with another officer "somewhere in France." The message started, but could not reach its destination for at least eight hours. Orders were given the United States engineering corps to remedy the matter without delay, and in less than two days messages were being transmitted from one point to another in ten minutes.

The work of the Americans in building telephone systems is a wonder to the French. Over 1,000 employes of the Bell telephone system of this country volunteered for service and are in France today. They are all experienced men. What has been done in the way of the telephone service by the United States will only be duplicated by the army when it gets into action.

Communication

Transmission of Intelligence by Smoke, Flash and Wire From the New York "Edison Monthly"

SIGNALING and the apparatus of signaling—by way of reverting to a former theme—are, quite as much as language itself, the result of a process of development. Theoretically, any of the senses might serve as a medium for the transmission of secret information, but the use of tastes and odors for this purpose is confined chiefly to fairy-lore and other fiction, sight and hearing being the only senses which are practically available. Hence the usual classification of signals as visual and auditory.

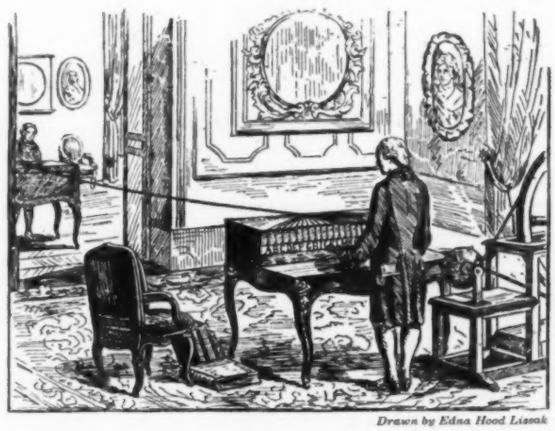
Of these, without doubt, the visual signal is the more important, although the range of auditory signaling was greatly increased by the introduction of cannon and the invention of the fog horn, siren and whistle. In modern aerial warfare the auditory signal is frequently resorted to, the source of the sound being the engine of the aeroplane, and the interruptions necessary to secure the time intervals which adapt the message to code being produced by means of a switch. The only important advantage which the auditory signal can claim over the visual is its adaptability to adverse weather conditions, but, while by the use of a code secrecy may be secured, the range of sound is limited and in time of battle the booming of cannon is a disturbing factor.

Drawn by Edna Hood Lisenk

Acetylene Lamp Used in the Okanogan National Forest, Washington.

Nevertheless, auditory signals are employed for a variety of purposes. One of the latest English contrivances, which, it is hoped, will not become a necessity in America, is an electric alarm designed to advise householders that Zeppelins are in the offing. Homes supplied with these useful instruments are warned of approaching danger by the shutting off of the electric current, the interruption causing an electric bell to ring continuously and a light, sufficient for temporary use, to appear, the current for bell and light being supplied by a small battery.

Among visual signals for use either by day or by night, the semaphore has long occupied a position of trust and importance. In its simplest—and perhaps aboriginal—form, as found among the Eskimos, who require no other apparatus than that provided by nature, it consists of the signal man himself with one or both arms laterally extended at angles required by the message of his code. Standing upon a hill, where his movements are plainly visible at a distance, and with his body facing the observer, he signals his message, "Come here," by moving his right arm upward and downward, while by a similar movement of the left arm he signifies that those indispensable carriers, the Eskimo dogs, must be brought. By other signs this human semaphore transmits the information that deer are to be found in his locality, and in the sign language of the frozen north he may relate the story of their capture.



Drawn by Edna Hood Lisenk

The Electric Telegraph of Lesage, Built in Geneva in 1774, Provided a Wire for Each Letter of the Alphabet. A Static Machine Provided the Necessary Current.

Probably the semaphore, which has played so great a part in naval, and to a less extent in army, signaling, had its origin in such a natural adaptation of the language of gesture to distant communication. But its history is obscure, and when, after the middle ages, the semaphore was introduced into Europe, its use, like that of spectacles, telescopes and other inventions which extended the range of the senses, was opposed on religious grounds. In principle it consists of an upright beam of varying length, with a cross-beam turning on a pivot and bearing at each end a smaller beam, capable, like the first, of being rotated through various positions. The semaphore was adapted to naval and railroad signaling by night by hanging lanterns from the arms, thus indicating their position. On shipboard the instrument was sometimes set up on the deck and sometimes fixed at the masthead.

The British Admiralty adopted the semaphore from the French and in the same year that M. Chaffe brought out his invention Lord George Murray's shutter telegraph appeared. It consisted of six shutters working upon a central pivot. By exhibiting the flat side of the shutter or presenting the edge (thus concealing the shutter) code messages could be given. During the Napoleonic wars this method of signaling was employed, and it is stated that as a record performance messages were sent from Plymouth to London in ten or twelve minutes, although in 1806, in the year that this was accomplished, these places were separated by a three days' journey. However, the shutter telegraph gave place to the semaphore, which in turn yielded on the last day of 1847 to the superiority of the telegraph.

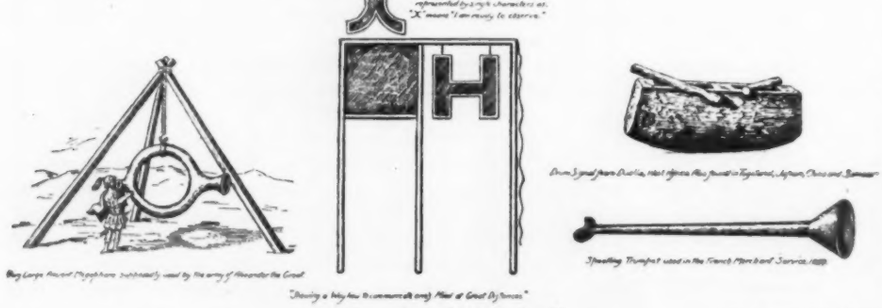
As the fate of armies has often

depended upon the speedy and accurate transmission of a message, it is strange that signaling received so little attention until the seventeenth century was nearly spent. To be sure, guns and lanterns by night, and by day flags displayed in various parts of the ship had, in naval maneuvers, served to transmit orders, but no approach to genuine serviceability was attained until, in 1780, Admiral Kempenfeldt produced

Drawn by Edna Hood Lissak

The Telephone and the Heliograph in the National Forests of California. Messages Are Received by Helio from Outlying Stations and Relayed by Phone to Headquarters.

his code book with flags and messages upon opposite pages. A few years later improvement was made by numbering the flags from 1 to 10. It was found that by this means no less than 310 messages could be sent by the admiral to his fleet, although the number of possible responses was more limited. Then with the beginning of the nineteenth century the system of Admiral Sir Home Popham, which, by making use of lettered flags in pairs, provided for the sending of messages not prearranged, was adopted in the British Navy, and it was with this system that Lord Nelson signaled to his ships the words that have since fired the hearts of many Englishmen, "England expects every man to do his duty."



Drawn by Edna Hood Lissak

Various Devices for Transmitting Intelligence.

In the navy, conditions permit the use of many flags of various colors, their color and position one above another indicating the message of the code book, while for signaling at distances too great for colors to be distinguished the message is conveyed by the shape and position of the flags. Flag signaling in the army is to a much greater extent dependent upon motion, as seen in the wig-wag system, which was used in the United States before the adoption of the Morse code. By waving a flag to the right and to the left any desired combination of the numbers 1 and 2 could be signaled, the numbers corresponding to letters.

But one of the most effective forms of signaling is yet to be mentioned. That it possesses the merit of extraordinary secrecy is known to every schoolboy who has profited by the fun-producing properties of a small pocket mirror to dispel the gloom of study hours. Rapidity of operation, portability and range are other properties which have made the heliograph one of the best instruments for signaling that have ever been devised. It consists of a small mirror carried on the end of a bar, which is mounted on a tripod, and it is so operated by means of a key, which throws the mirror out of alignment that light may be reflected upon a second mirror at the opposite station. The light rays are directed as a rifle provided with a peep-sight would be aimed, a small unsilvered spot in the center of the mirror serving instead of the rear sight and the sighting bar taking the place of the rifle barrel. The sighting of the instrument is not complete until by the use of slow motion screws the mirror has been so turned that its unsilvered portion has cast a "shadow spot" upon the exact center of a disk carried by the sighting rod. When this is accomplished the flash is visible at the receiving station.

The secrecy of the heliograph message is insured by the fact that at a distance of one mile the circle of illumination caused by the flash is only 16 2-3 yards in diameter, the diameter increasing with each mile by the same amount. The extreme range of the heliograph, being limited only by the convexity of the earth, is asserted to be, under favorable conditions, from ninety to one hundred miles, but messages have been transmitted by its means over longer distances, notably that sent by Capt. Gassford, of the United States Signal Corps, between Mt. Uncompahgre in Colorado and Mt. Ellen in Utah, the distance being 183 miles. In all recent wars it has played an important part, and it is said that in the Boer War the British placed chief reliance upon this mode of signaling. In 1880 it effected the release of the besieged garrison of Kandahar, which for several hours carried on a communication with Lord Roberts' relieving force over the heads of the enemy. Recent modifications have been made, but the principle of the heliograph, known also to the Indian, who with his mirror flashes messages from hill to hill, remains the same.

After-theater suppers the first of the week often mean free lunch along towards Saturday.

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SCHOLZ

TELEPHONY IN THE UNITED STATES VIEWED THROUGH FRENCH EYES.—The special mission which the Bureau of Postes and Telegraphs (which abroad also includes telephones) sent to the United States has just returned to France, after studying our telephone, telegraph and postal departments in detail. Its members were struck by the good-will shown them by our American engineers, the more so since many of the secrets which would have been withheld from our former commercial competitors were now gladly opened up to our French allies. It is not often that we can supply the words of Robert Burns:

O wad some pow'r the giftie'd gie us
To see ourscls as ithers see us!

But for once this is true for the telephone field, and it will no doubt be of interest to our readers to see how French telephone engineers, trained to French methods, judge our American telephone system and its management.

It was in the United States that the telephone was born and since its arrival it has not stopped growing or developing. On the first of January, 1911, there were in the United States 7,595,938 subscribers. In the single year 1910, 600,246 new subscribers were installed, which represents a growth of 8.6 per cent. In 1911 there were 8.1 telephones per 100 capita population.

The European war having brought to the United States increased activity in all branches of industry, it also increased the telephone field and by this time the number of subscribers has reached approximately ten millions.

That same year the length of telephone wire connected had reached 16,633,590 miles and 9 per cent of this length was laid in one single year, in 1910. The capital invested in the various telephone systems has been valued at $956,700,000, which is equivalent to 5,000 million francs.

The number of telephone connections made over this enormous system during 1911 was about 14,500 million connections, which gives, even at this early date, fourth rank to the American telephone business among all the fields of industry; a fact all the more remarkable, as the telephone entered into actual practical use only in 1875. Only the iron and steel industry, the timber industry, and heating and lighting industry surpass the telephone field in the matter of invested capital and the annual working capacity. In fact, this extraordinary development of the telephone along with the many other electrical means of transportation and communication surprised the visitors to the United States.

In every hotel in the United States there is a telephone instrument in each room and a telephone switchboard served by one or more operators, who are constantly on duty. All of the business houses, the warehouses, large stores and offices have their own telephone installations with their numerous exchanges, many of them very intricate and connected to the outside world by a number of trunk connections.

In the American business offices, where several dozens of employes are grouped around their managers or office heads in a large working office, like students grouped about the teacher, there is generally a telephone instrument at each desk. And these telephones do not interfere with each other, for they have a remarkable transmitting power and one can make himself understood quite a distance away over very long circuits without having to shout into the transmitter. In almost all public places, such as theaters, railroad stations, office buildings, there are prepayment telephone stations, where the public can telephone. These stations are either placed in telephone booths, or else set along the walls, in groups or isolated. Where they are grouped, as we have in the large office building lobbies, there is usually a telephone operator who takes care of the public wishing to use the telephones.

All these telephone stations are used for local, suburban and long distance telephone work, but the largest use of telephones is made for intetrurban calls. The use of the "no delay system," which is very little known in Europe, is of great use to the public. In no case can the delay attendant on the user be more than 10 minutes. The telephone circuits and the operators in charge of them are too numerous ever to reach this 10-minute delay. As soon as a telephone is used by a person, an operator connects herself to this telephone and remains connected until the required subscriber has been reached or the call is satisfactorily accounted for in another way.

The long-distance operator need never resfuse her subscriber a connection, for she knows, through the "no delay system," that he will not have to wait too long, certainly not more than the 10 minutes, to reach his call. The telephone circuits, the pupinized underground and aerial cables are all so well developed, and in constant development, that the American telephone system may well be called the best in the world. Moreover, the telephone service itself is remarkably certain and the operators are able to perform splendid work. First of all, these employes are young and active; one is struck, when visiting the long-distance building and the main telephone building in New York and other large cities, by the extreme youth of all the operators (most of them seem to be between 17 and 25 years of age); all of them are splendidly supervised; besides the numerous supervisors, there are a half dozen or so wire chiefs, seated at their tables, who listen in on many of the calls and keep the mechanical part of the plugs and jacks always in good trim. Listening-in jacks and lamps used for supervision at various supervising tables permit other supervisors to tell, accurately, the interval of time elapsing between the various steps of a communication. They watch over the time of the subscriber's call, the time taken by the operator to answer, the call from one of the urban exchanges and the answer of another exchange, the call from the exchange to the desired subscriber, the answer of that subscriber, and so on to the end of the conversation. The supervisors thus are able to keep a check on all their operators and the results obtained from this policy of watchful supervision is used both as a basis for statistics in the department and for increases in salaries to the most efficient of the operators.

In the telephonic personnel of the American telephone system the youth of the managers or chiefs of departments strikes one as much as the youth of the operators. The inspectors and chiefs of the various sections

of the city exchange system seem to be between 25 and 30 years of age. The engineers in the American Telephone Company and the Western Electric Company, both of which companies were visited by the commission, had the air of young men, though they occupied high positions in many instances. To be sure, the higher posts dealing with matters of finance, of general policy and commercial policy, were held by older men who had the experience of many years of service. But beside them served a multitude of young men, many of them filling positions of responsibility and power.

M. Valensi, the high commissioner, who made this report, had occasion to see the engineers of the American Telephone Company at actual work. M. Carty, chief engineer, at present major in the American Army and in charge of the telegraph and telephone work of the army in France, had charge of the work. As M. Valensi had been connected for two and a half years with the telephone work in the French army, he was able to follow the lecture of Mr. Carty with ease and at the same time study the personnel of the American staff of engineers at his leisure. Mr. Carty gathered his engineers about him and discussed with them the various problems that had to be solve in army telephone work. This conference was typical of the manner in which the large American firms carry on their work. When a new problem comes up, the chief engineer gathers about him his engineers and discusses all points quite freely and openly.

The discussions are always cordial, thanks to the tact of the chief, but they are also very fruitful, for the chief in charge interrogates the humblest as well as the highest of his engineers with a cordiality, a courtesy and a consideration which puts everyone at his ease. From these discussions arise the orders, which are signed by the chiefs in charge, based on the results of the deliberations. Each, being allowed to take part in the discussion, feels he has a part in the final decision and is satisfied with whatever the result may be. In this way the work grows, and all those engaged in it feel that they have had a share in the growth.

Neither vain desire for glory nor any idea of individualism animates these engineers. Their work and their researches remain anonymous; the work is known as that of the company which employs them. Their discoveries and the results of their efforts likewise go to the company, which to them is a sort of fatherland on a small scale. At the conferences just mentioned, each man acquires a sentiment, which is nothing when standing alone, but has the same relation to the whole as each cog in a gigantic machine. It means progress when taken in that relation and this progress is the result of organized collaboration of many efforts reaching out into all directions and in all senses. Three forms of intellectual activity are represented in the work of the engineers of not only the greatest, but also of the smaller telephone companies and the associations designing and manufacturing telephone instruments and equipments. These are: Pure science, technical industrial research and the exploiting industry. Nothing is more natural than that individualism be expressed in pure science; the great scientists are like venturesome acrobats, who make bold inroads into the world of the unknown. But in technical industry and in the field of exploiting and commercial industry individualism has no place. The man who thinks that he has discovered something of great scientific value in thinking out, for example, a new telephone instrument or a new type of desk or wall telephone or a new mode of constructing telephone lines, is the victim of a great illusion of vanity. He has not conquered a hand's breadth territory of that vast realm which we call by the word "unknown"; he has not brought us a trifle nearer to the boundary which is stretched between the knowledge which we possess and the mystery which surrounds us. All these things have but a commercial value and consequently a particular name has to be attached to them. They belong to the commercial society of which the inventor is a part. Yet there must be some recompense made to the inventors and this recognition the young American engineers and inventors in the employ of the great telephone companies obtain either in the line of pecuniary rewards or advancement.

Advancement by selection, based on the work performed and merit is one of the rules in the American commercial organizations in this field. When an employe has not value sufficient to be nominated to a superior position, his advancement is commercially impossible, for the operating expenses would be increased without adequate returns being guaranteed. Every enterprise must make financial returns. On the contrary, if a man possesses qualities of intelligence, of scientific worth, of good-will and of superior activity that entitle him to promotion, his superiors will advance him in keeping with his merits not only on account of the commercial value which will accrue to the firm through his advancement, but also for his own sake. And this man will work better as a result of his advancement and will bring more returns to the company. These rules of advancement are not restricted to the manufacturing end of the telephone business, but they hold true right through the entire telephone field.

Research and investigations carried on among the telephone clientele are among the characteristics of American telephone practice. Special agents in each of the American telephone exchanges note down the names of those subscribers whose telephone conversations do not seem to come up to the expectations which might be entertained owing to the social or business standing of the individual. These agents call on the subscribers in question, lay the matter before them, prove to them from statistics that the increased used of the telephone will mean more business at greater saving for them and will often and usually end in a greater volume of business for the telephone company and to the user.

The French committee was also struck with astonishment by the engineering department maintained by one of the greatest of the American telephone operating companies, whose lines are spread all over our continent. Aside from the standardization work of this department and the work with troublesome features of telephone operation and their elimination, it also carries on theoretical studies. Transmission studies are carried on over urban, suburban and long distance lines, over the lines and instruments of the subscribers and over every portion of telephone equipment. It is this service which has succeeded in perfecting the telephone relay, which helps to increase the transmission distances more and more and to reduce the quantity of copper to be used in constructing the lines.

A special section of the engineering department devotes itself to the development of the telephone transmission system itself. Although these so-called "development studies" are really parts of the commercial and financial fields of the telephone company, yet they require men of engineering training and ability to carry out. The engineers of this branch of the service study the growth and development of every town and district that comes

within the network of wires of the company. The representative engineers in this work discuss their findings with the engineers in charge of the associated companies within whose territories these towns lie. They show them through statistics from fields similar to their own, how they can increase the business or correct faults within their own district. These engineers are highly trained men; they have worked up through the practical end to the positions of development studies. These men are practical men, for the American thinks that mathematical research and the work of the theoretical laboratory on the one hand, and the administrative work and field of applied technology, the "field work," on the other hand, do not go hand in hand, but must be kept separated.

That is why the determination and standardization of the best apparatus to be used in telephone operation, or the best method of exploitation, or the best and most economic methods of construction, as all other great projects of telephone development are done by the engineering department of the company, whose management impressed these commissioners so highly. This department gathers information of technical points not only from all the telephone associations united with itself, but also from telephone and engineering periodicals and papers not only of American, but also from all foreign sources. Any industry which has even the most distant connection with or influence on the telephone field is studied and the results and publications relating to it are kept on file and gathered. This service has representatives in all parts of Europe, and as soon as something new occurs in any part of the world a report is made to the headquarters of this service department.

Here, then, we have the two great departments dealing with the telephone system, the remarkable telephone organization in the United States: the scientific character and the commercial character. It is owing to these two features that the country in which the telephone was born has reached and kept at the head of all the countries of the world that employ the telephone.—*M. Pomey and M. Valensi, members of the French Mission to the United States of the "Administration des Postes et Telegraphes."—Annales des Telegraphes et Telephones.*

SOME ELECTRIC CONSTANTS OF AERIAL TELEPHONE CIRCUITS.

Some time ago the French Department of Telegraphs and Telephones made some investigations in its telephone research department, dealing with the electric constants of aerial telephone circuits. These constants were determined at the time by theoretical means, without attempts to find out how near the theoretical observations came to practical tests.

It will be interesting to see how near the actual tests came to the theoretical computations. A few words will have to be said first, though, concerning the experiments, the calculations and what degree of confidence can be placed in the theoretical theories set up by the French engineers.

The experimental tests were made by means of a telephone bridge, using it to determine the value of impedance in an open and in a closed circuit. The telephone line which was studied consisted of 4 mm. (0.16 in.) copper wire and had a length of 190 km. (115 miles). The wires were strung along poles which followed the line of one of the French railways. Except for a short section of about 400 feet, where the line passes through the Rochette tunnel, the line is entirely aerial. There is no fear, then, of any phenomena of reflexion, and the line may be called homogeneous. Careful precautions were also taken so as to have the frequency of the sinusoïdal current accurately determined and kept as constant as possible throughout the tests.

When we pass to the calculation of the kilometric value of constants, we know that the operations are frequently very laborious in execution and that the success obtained does not always correspond to the trouble taken. This is partly due to the fact that the calculations are based on the assumption that the telephone line is homogeneous. Even if it turns out to be true that the self-inductance and the capacity have in general the same average value along the whole length of the line, yet the insulation factors are often quite irregular. In supposing the electrical properties of the telephone line uniformly distributed over the entire line, one frequently assumes a hypothesis which does not correspond to the facts in the case. If, then, in making real tests, the theoretical observations prove to be correct or nearly so, we have proof that the hypothesis of the homogeneous state of the line was correct.

In the present case, although working with a telephone line which was quite long for such tests and where some particular faults were always to be feared, the results were of astonishing agreement with the theoretical calculations. In the six series of observations made there were not even three or four which gave widely divergent results, and even here the factors found for the capacity and the self-induction could be kept, as agreeing with the theoretical calculations, for we know that the values which are mostly troubles by experimental errors are the resistance and the electric losses.

The following table gives the results of the tests taken during the worst months in the year:

TABLE I. TABLE OF TELEPHONE CONSTANTS.

Date.	*Weather.*	*Total Breakdown Factor.*	*Resistance, Ohms.*	*Electric Losses* 10^{-6}	*Self-Induction* 10^{-3} *Henry*	*Capacity* 10^{-6} *Farad*
June	Wet and hot	0,470	2,75	1,24	2,37	5,35
June	Rainy	0,400	2,68	0,18	2,19	5,26
June	Rainy	0,455	2,49	1,50	2,36	5,05
June	Rainy	0,470	2,58	1,50	2,29	5,54
November	Very rainy	0,425	....	....	2,26	5,83
November	Very rainy	0,415	....	....	2,42	5,35
November	Very rainy	0,440	....	....	2,37	5,61
November	Very rainy	0,430	2,64	0,90	2,31	5,58
November	Very rainy	0,450	3,08	0,40	2,38	5,35
November	Dry and cold	0,430	2,61	0,77	2,31	5,56
November	Wet and cold	0,420	2,97	0,10	2,40	5,36
January	Very wet	0,410	2,50	0,68	2,32	5,54
January	Snow	0,460	2,52	1,10	2,29	5,84
January	Dry and cold	0,395	2,43	0,43	2,22	5,66
January	Dry and cold	0,400	2,68	0,10	2,27	5,49
January	Dry and cold	0,435	....	....	2,34	5,39
	Averages	0,433	2,66	0,74	2,32	5,48
	Corrected to 0° C.	0,428	2,63	0,74	2,36	5,62

In comparing the results of the experiments with the theoretical results, the following conclusions can be drawn: 1. There is a remarkable agreement between theoretical and practical results. The theoretical formulæ can therefore be applied to aerial lines. 2. The figures found for the resistance differ only by 10 per cent on the average from the theoretical results calculated. One can therefore assume that the figures for the electric losses are also correct. This conclusion is also reached when observing that the breakdown factor varies in the same sense as the electric losses, which also confirms the theoretical findings. 3. From these observations correct conclusions can be drawn as to the electric losses, which factor is an element of which very little is known in

comparison to other values and which losses depend greatly on atmospheric conditions.

The experiments were made on purpose in the worst weather during the year, for it can be assumed that if the observations were made in the worst weather in the season, they will be far more favorable at other times, where the weather conditions are more favorable. The value 1.5×10^{-6} seems, then, to be the proper one with which to figure. Admitting these results to be correct, certain very interesting conclusions may be drawn concerning pupinization. It is well known that it is not possible to make any accurate allowance for the breakdown factor, unless one knows the values which one will have to deal with in relation to the insulation of the lines.

What conclusions can then be drawn, if one wishes to pupinize a 4 mm. telephone line? It is easily calculated that if one pupinizes the line by giving it the most favorable self-inductance, and if one follows the English rule as to distances between pupin coils, these will have to be placed every 19 km. (11.4 miles). It would seem that one would do better by giving the coils a more feeble self-inductance than the 0^h125, usually advised. In the measure as one digresses sensibly from the maximum self-inductance, the distortion diminishes, as also the characteristic, which approaches that of the ordinary telephone lines.

When using the 0^h100 coils as it was proposed, the breakdown factors shown in the following table are obtained, which values are true not only for the various electric losses, as also for distances between coils ranging from 10-20 km. (6-12 miles):

Table of Kilometric Breakdown Values.

	Without coils.	*With coils every 6 miles.*	*—every 12 miles.*
0.1×10^{-6}	2.19×10^{-3}	1.18×10^{-3}	1.37
0.5	2.32	1.47	1.61
1.0	2.49	1.84	1.90
1.5	2.65	2.21	2.19
2.0	2.82	2.58	2.48

This shows how the breakdown factor of pupinized lines increases when the insulation decreases. The advantage of pupinization disappears, therefore, beyond a certain limit. In the case of the 4 mm. copper wire, this limit will not be reached, but placing the coils closer, i. e., every 6 miles, will give good results only when the electric losses are less than 1.5×10^{-6}. As experience seems to have shown in these cases that the value of the electric losses in most cases are smaller than this number, it seems advantageous to place the pupin coils at distances of 10 km. (6 miles).—*M. Devaux-Charbonnel.—Annales des Telegraphes et Telephones.*

War Effect on Chicago Earnings

Chicago Telephone Company presents a graphic illustration of the change wrought in public utilities by the war, as far as earnings are concerned. Despite the fact that 1917 business will be the largest in its history, it is improbable that the company will show a surplus for the calendar year of more than $1,000,000. Gross earnings for eleven months ended with November were approximately $19,658,146, while net earnings were only $4,558,140 in the same period. Total income for the eleven months was only about $16,000 less than for the full year in 1916, but net earnings for eleven months were more than $656,000 smaller than in the corresponding period a year ago.

When the full year's report is issued it will probably show that total revenues in 1917 were not far from $21,000,000, the greatest in its history. Net earnings, however, present an entirely different situation, as they probably will not even be $5,000,000. Operating income is even worse off, as it is estimated that for the full calendar year of 1917 it will total something in the neighborhood of $3,500,000, compared with $4,413,115 in 1916. Surplus will show up even less favorably, as dividend requirements this year will be $2,500,000, compared with $2,220,000 in 1916.

Eleven months' earnings of Chicago Telephone Company present an interesting study. Following are the totals of the three most important items by months thus far in 1917, together with the approximate totals of each:

	Gross.	Net.	Oper. income.
January	$ 1,842,820	$ 596,480	$ 492,291
February	1,711,238	475,658	361,900
March	1,797,145	482,252	371,339
April	1,808,742	445,336	331,514
May	1,811,961	422,668	305,515
June	1,805,499	396,751	274,938
July	1,711,561	287,547	158,342
August	1,773,454	330,611	206,688
September	1,786,930	352,829	224,417
October	1,802,811	378,285	245,349
November	1,805,985	389,723	256,246
Total	$19,658,146	$4,558,140	$3,228,539

In only three months—January, February and March—were net earnings above the corresponding period of last year, while operating income showed an increase in January only, compared with 1916. Gross earnings, on the other hand, showed an increase for every single month, the gains ranging from $103,963 to $234,041. The net changes (exclusive of cents) of the three items for each of the first eleven months of 1917 follow:

	Gross increase.	Net decrease.	Oper. income decrease.
January	$234,041	*$ 96,496	*$ 93,194
February	179,845	*14,722	470
March	189,905	*7,130	2,837
April	198,570	40,618	53,710
May	181,080	13,563	29,244
June	127,534	107,239	134,272
July	160,806	143,592	181,859
August	143,308	98,748	124,603
September	132,772	115,331	143,868
October	134,314	80,545	113,784
November	103,963	95,256	127,179

*Increase.

Three items of expense account for practically the entire situation—labor, materials and taxes. These same three items are affecting practically every industry in the country, but public utility corporations are the hardest hit, as very few of them have been allowed a corresponding increase in the charge for service.

An official of the Chicago Telephone Company says that whereas copper wire cost 15 cents a pound at the most before the war began to have its effect, it now costs 30 to 36 cents. Other materials have increased 25, 50 and even 100 per cent in cost.

In consequence of this very little new work is being undertaken. It has always been the policy of the Chicago Telephone Company to keep a reserve of cable, building and plant resources, and these have been heavily drawn upon to keep the property in good physical condition. "All business not vital to the winning of the war is being sidetracked," said one official. Proof of this can be found in the fact that no private residence telephones have been installed since May except in emergency cases.

Report for Vocational Education

"The war has fortunately brought home to the country both our need for vocationally trained men and women and our lack of facilities for training men and women vocationally," declares the Federal Board of Vocational Education in its first annual report to Congress. "The war had, so to speak, found the United States vocationally unprepared."

In the four months since its organization the Federal board records the following steps of progress:

Acceptance of the vocational education act by 46 of the 48 States. Approval of plans for vocational educational systems for 22 States, involving an expenditure this year of more than $850,000 of Federal money and at least an equal amount of State money. Regionalizing of the United States for administrative purposes and establishing working relations with State school officials. Publication of a statement of policies.

Establishment of more than 50 night classes to train radio and buzzer operators for the United States army, with an enrollment of well toward 3,000 and still growing rapidly.

Working out a system of vocational training for the Quartermaster's Corps, the Engineer Corps and the United States Shipping Board.

"By far the most important even of the 12 months just passed in vocational education," says the report, "was the passage of the Smith-Hughes Act. This event has marked the beginning of a new era in vocational education in the United States. From now on vocational education is a matter to which the energies of both State and Federal governments will be directed. Its establishment means much for the defense as well as for the prosperity of the people of the country. It means an immediate extension of our secondary public school system so as to furnish practical education for the wage-earning employments. It means, furthermore, that this extension will be carefully planned and ordered. It means an end to haphazard extension of vocational education. It means that a program can be agreed upon and can be developed progressively from year to year."

New York Independent Buys Bell

Manager G. E. Purple of the Northern Tioga Telephone Company, New York, has concluded the purchase from the Bell Telephone Company of the Bell line from Newark Valley to Richford. This is the old original Bell line through this valley before the Northern Tioga Telephone Company was organized. It is a copper line, and from the Decker crossing, north of Newark Valley, it runs to Richford on farm lands adjoining the railway tracks.

With the purchase of this line the Northern Tioga company will proceed at once to bring the newly acquired subscribers of the Berkshire company into the service of the Newark Valley central and the Berkshire central will be abandoned. All of the sixty telephones on the old Berkshire lines will be served from Newark Valley, except five telephones in the town of Richford, which will go to the Richford exchange. It has been expected to make this change in the spring, but the troubles of the mixed exchanges have been annoying. Several Berkshire subscribers have had to call Newark Valley and then go through the Berkshire exchange in order to reach the stores or near neighbors. There has not been enough business at the Berkshire exchange to warrant employment of an operator to remain at the board continuously and thus, while the Berkshire exchange in charge of Mrs. I. H. Cleveland has had excellent service as far as intended and could be expected, it is expected to give quicker service through a regularly operated exchange. While the Berkshire lines will necessarily be pretty heavily loaded for the winter, the Newark Valley-Berkshire pole line will be practically rebuilt in the spring and new wires added to take care of the service.

Of late years it has been the policy of the Bell company to leave local business to local companies, where they are equipped to handle it and they wishing only the long distance connection; hence the sale of this line.

Jacksonville Would Own Exchange

A meeting of a committee of fifty citizens, with L. L. Meggs, chairman, was held in the office of the county commissioners at Jacksonville, Fla., for the purpose of considering the advisability of the purchase by the City of Jacksonville of the Home Telephone Company, now in the hands of a receiver. It was pointed out that the city now had an opportunity to secure a public utility at about half-price, and thus be enabled to give the people of Jacksonville a service at nominal cost. A list of those cities having competitive service were read, along with those in the grip of a monopoly, and in every city where there was a privately owned or municipally owned and operated plant in competition with others, the price was about one-half. The Home Telephone Company's plant is valued at something like a million dollars, and to acquire this property it would be necessary for the city to satisfy the creditors to an amount said to be around $600,000. A number of the stockholders have signified a willingness to have the city take over the company.

The committee of citizens who are interested in seeing the deal put over are not stockholders in the Home Telephone Company or otherwise interested, but they do see an opportunity for the city to acquire an industrial plant that they believe can be made as good an investment for the people as the electric light plant has proven.

Telephone Merger in Colon and Panama

It is announced that the Isthmian Telephone Co., at Colon, will cease to operate as a separate corporation on December 10, but will be merged into the Panama Telephone Co., which recently came under the control of the electric light and power syndicate which operates in Panama under the name of the Compañia Panameña de Fuerza y Luz and in Colon under the name of the Colon Electric & Ice Supply Co. The four important public utilities in Colon and Panama—electric light, power, ice, and telephones—are now under one general management controlled by an American syndicate.

Soot Short Circuits Insulators

Trouble that has beset a new line of the Western Union Telegraph Company between Eugene, Ore., and Marshfield, Wyo., since it was constructed and which had been a puzzle to electricians, is believed to have been solved. It has been found that where the wires run through a 4,800-foot railroad tunnel the insulators have been made conductive by soot from locomotives.

Public Utility Commission News

Reports Concerning the Activities of State Regulating Bodies in the Telephone Field

California

THE application of the Interstate Telegraph Company for permission to collect from Round Valley telephone patrons according to the company's schedule of rates, has been granted by the State Railroad Commission.

Nineteen Round Valley subscribers will be effected by the commission's order, which goes into force on January 1. Thirteen of these are now paying $1.75 per month each, three are paying $2.50 and one is paying $2.00 per month. They will now all pay an even rate of $3.00 per month.

A number of subscribers on "ranch lines" outside of Round Valley, who have been paying less than the regular published rate have agreed to an increase without appeal to the Railroad Commission.

The telephone line to Round Valley was built in 1906 and a portion of the construction cost was paid by the subscribers and these were given a contract for service at lower than the regular prices. This contract has now expired.

The Southwestern Home Telephone Company, which operates in Redlands, San Bernardino county, and many parts of Riverside county, has filed with the railroad commission an application for authority to readjust its finances.

In the application the company asks permission to issue two-year 6 per cent promissory notes to take up its matured and maturing obligations of $89,050, and to pledge as collateral security its bonds in the ratio of $2,000 for $1,000 of notes.

It also is the request of the company to obtain from the stockholders at least two-thirds of the bonds issued and outstanding, exclusive of the collateral bonds held by note-holders, amounting to $177,000.

The company has asked for an agreement to suspend payment of interest coupons due April 1 of each year, for ten years.

The rehearing of the Pacific Telephone Company's plan to increase rates and do away with free tolls in Orange county, which the Associated Chambers of Commerce of the county is fighting will be held Friday, January 4, at the courthouse. Commissioner Edgerton will be present when the case is reopened. The petition for a rehearing was granted some weeks ago.

District of Columbia

That it will be necessary to install a switchboard costing $150,000 for temporary use of the War Department is one of the arguments advanced by the Chesapeake and Potomac Telephone Company in asking the commissioners for aid in bearing extra war expenses in Washington. The switchboard will become useless after the war, the company says.

"Let us take more money from our profits to put into our annual depreciation fund," was what the representatives of the company asked of the commissioners at the hearing. In their report of July 7, last, the commissioners said that the company should reserve 3.46 per cent of their annual profits to insure their property against losses due to depreciation. The company asks that this percentage be increased to 4.87. This difference of 1.41 per cent, seemingly small, represents thousands of dollars that might be given out by the company in dividends to its stockholders, many of whom live in Washington.

"This is a hard business problem," said Robert V. Marye, general counsel of the Bell Telephone Company. "It is not merely an argument in which one side is trying to beat the other. I do not want to win if a sting is left that will hurt my client, the corporation. It is far better for me to lose if by so doing I can leave the telephone company well thought of in Washington."

Washington's telephone service is characterized as "worse than ever before," and protest against any increase in rates is registered in resolutions presented to the Public Utilities Commission by the Connecticut Avenue Citizens' Association.

The resolutions were adopted after a lengthy discussion of the telephone situation in which many uncomplimentary things were said about the service given by the Chesapeake and Potomac Company. One paragraph of the resolutions says "the people of Washington are paying for a telephone service far more inefficient and unreliable than ever before in the history of Washington."

It is held by the association that the Bureau of Standards is in a position to study and report on the conditions for telephone service in Washington, "and will, if requested by the Public Utilities Commission cooperate with that body in the hearings to be conducted on the application of the Chesapeake and Potomac Telephone Company for permission to increase its rates in the District of Columbia, and will, without cost to the commission, furnish expert advice which it is believed will be helpful to the commission in determining whether the telephone company is justly entitled to such increase of rates and restrictions of service as are proposed in the application."

Illinois

An indefinite continuance of the hearing before the State Public Utilities Commission relative to the proposed increase in telephone rates by the Stephenson County Telephone Company, was granted by the commission on request of the representatives of the city of Freeport who attended the meeting, which was held in Chicago.

City Attorney Louis Reinhold, Aldermen Broderick and Hill attended the meeting as representatives of the city of Freeport and General Manager G. X. Hannon, of the telephone company, was also present. When the meeting was called to order Attorney Reinhold made a motion that the hearing be continued, inasmuch as the city of Freeport protested against the proposed increase of rates and did not have ample time in which to make proper investigations and present a tangible case. The application as presented by the telephone company was read, which would not affect the general run of subscribers but that it was for an increase in certain districts for rural patrons and also for certain private users. As the meeting proceeded, Mr. Hannon asked that certain requests be suspended for the present and then it was agreed that the local company present a schedule of rates of the

proposed increase to the council and permit the city to obtain a clear knowledge of the request. This was agreed to by both sides and the meeting was adjourned, subject to the call of the commission.

Attorney Reinhold was informed that the state association of telephone companies had requested the board to impose a penalty on subscribers who did not pay up by a certain date and that the commission had passed upon the request favorably to the companies and it would be effective some time later.

Maryland

The Public Service Commission has issued a formal order postponing the fixing of rates for the Chesapeake and Potomac Telephone Company. The order states that the postponement holds until business conditions have settled or until it shall appear that the interests of the public dictate an adjustment of the rates, regardless of unsettled conditions. Specific complaints against the Chesapeake and Potomac will be considered as usual.

The commission's order, after calling attention to the representations in favor of postponement from the company and the acquiescence by the Protective Telephone Association and various civic organizations because of war conditions, reads:

"Nothing contained in this order shall be taken as in any way precluding this commission from inquiring into and passing upon specific complaints made heretofore or hereafter from time to time of its own motion or by the respondent company or members of the general public, of individual or particular rates, charges or practices on the ground that they are discriminatory or otherwise unreasonable or unjust so long as such specific complaints do not involve an inquiry into the general readjustment of the rates, charges and practices of the respondent company, and may properly and reasonably be passed upon under conditions existing at the time such complaint or complaints may come to be heard."

Massachusetts

A hearing on the suspension of telephone service granted to Thomas J. Mann, a plumber at 101 Park street, West Roxbury, by the New England Telephone Company in connection with alleged abuse of operators, was given before the public service commission.

Counsel for the telephone company said the service of other subscribers had been impaired, and telephone employes and operators abused by blasphemous language uttered on numerous occasions by Mann. They also brought out that representatives of the company had interviewed Mann in an attempt to have him desist from upbraiding operators for what he called "poor service."

Miss Florence A. Egan, who has been employed in the Bellevue central office for the company as an operator for two years, told of the use of profane language to her by Mann. Miss Ellen C. Halloran, senior operator, also said Mann had used abusive language to her over the telephone in complaining of service. Other witnesses told how Mann's alleged repeated complaints and outbursts of profanity had annoyed them.

Mann is a resident of Dedham, but maintains an office at 101 Park street, West Roxbury. He said he had difficulty in getting good service, and as a result of his complaints, telephone service was discontinued to his office on November 20. He testified he would have to go out of business if service was not restored, and offered to make an apology to employes or operators for abusive language which he admitted he had used on various occasions.

The case was taken under advisement by the public service commission.

Missouri

J. H. Christopher, vice president of the Meisner Telephone Company, which operates rural lines in St. Louis and Jefferson counties, says that 300 of the company's 450 telephones practically have been put out of business from electric induction which he says was caused by a high voltage line recently installed by the Union Electric Light and Power Company. The new power line is said to parallel the telephone company's lines for almost eight miles.

The Missouri Public Service Commission heard a complaint of the Meisner Company against the operation of the new line. The Meisner Company asked that the electric company be compelled to metalize the parallel lines. The commission took the case under advisement.

The Meisner Company has exchanges at Pevely, Fenton and Beck and also serves subscribers in the vicinity of Festus, Kimmswick and Crystal City.

Montana

After a thorough consideration of the testimony in Inter-Mountain Telephone and Electric Company vs. The Mountain States Telephone and Telegraph Company, the railroad commission takes the stand that the parties to the controversy have failed to appreciate and understand the position of the commission in matters of this nature.

It is held that the act precludes the commissioners from considering the equitable provisions of a contract or the enforcement thereof. The controversy brought before the commission involves mainly a contract between the two corporations providing for the division of certain tolls. Complainant alleges that unless a more equitable adjustment of earnings is made it will suffer great injury. The commission holds that a legal remedy is provided in the premises.

The defendant company advanced the contention that the commission had no authority because no rate matters were involved. The commission maintains that it has an absolute right to see that the contract between the two corporations shall not provide for a greater or less division of profits than exists between the defendant company and other connecting lines.

The commission criticises both corporations for not having filed copies of contracts between them with the commission. In its order the commission says that the complaint, insofar as the interpretation or enforcement of contracts is concerned, is dismissed and that the complainant and defendant shall each file their connecting line contracts within twenty days.

Commissioner Hall does not concur in the order made by the railroad commission.

The Meagher County Telephone Company of Harlowtown secured a ruling from the Railroad Commission allowing it to raise its rates 75 cents a month on one-party lines and 25 cents on all others, it being provided that customers shall have a rebate of 25 cents in case they pay their bills before the tenth of the month. Commissioner J. H. Hall opposed the ruling.

The board found that the company had not declared any dividends in its eight years of life, but had invested surplus profits in the plant, which it rebuilt in 1913. The

board also required it to install a standard accounting system.

New York

The incoming Tammany administration will make an effort to lower telephone rates in Greater New York. Cornelius M. Sheehan of Brooklyn, representing Mayor-elect Hylan, appeared before the Public Service Commission of the 2d District and made an informal request that the commission schedule a hearing on telephone rates. Mr. Sheehan explained a formal request for a hearing would be held as soon as the new mayor took office.

"I appeared before the commission," said Mr. Sheehan, "merely to notify them of the intention of Mayor-elect Hylan to take up the matter of lower telephone rates when he takes office. We will make a definite request for a hearing as soon as Judge Hylan takes office, and will present our case at that time. Judge Hylan believes the present rates are too high and there should be substantial reductions."

The upstate commission met in the Hall of Records to consider the complaint of Bronx citizens against the telephone service in that borough. Henry Nordheim, an architect, of the Bronx, appeared as complainant of record against the New York Telephone Company in the case and filed a copious complaint with the commission.

The people of the Bronx complain that the general telephone service in that borough is very poor and that the telephone company does not employ a sufficient number of operators or maintain a sufficient number of exchanges. The complaint also states that the company should allow a rebate to customers when they do not use up all their calls under the limited service.

North Dakota

D. E. O'Brien, proprietor of the Home Telephone Exchange at Sykeston, complained to the rail board that the New Home Telephone Company is planning to build local and toll lines paralleling his. He advises there is not enough business at Sykeston for two companies, and notes that he has received authority from the railway commission to operate, while the New Home Telephone Company, he claims, has ignored the commission entirely.

Secretary Calderhead has written the new concern advising that if it attempts to construct wire lines and operate without first filing a petition with and obtaining permission from the rail board it will be prosecuted for the violation of a state law which is very explicit on this subject.

Oregon

The Pacific Telephone & Telegraph Company has filed with the Public Service Commission a proposal for the establishment of a new system of long distance rates in Oregon, the proposed system to be established on the zone or block basis, similar to the systems used by the telegraph and express companies.

It is stated that, under the proposal, if it is accepted by the commission, a reduction will be shown in 53 per cent of the rates, while about 22 per cent will remain the same and the balance will show increases.

The proposal shows an average charge of 6.10 of a cent per mile up to a distance of 40 miles, and after a distance of 40 miles the charges will be made by zones, or blocks. Each block will include 35 square miles. As an example, to determine a particular rate, if a party is calling from Portland to a town within the same block of 35 miles, as Ashland, he will be given the same rate as though he were talking to Ashland.

The proposed changes will be passed upon by the commission, probably at a formal hearing, before any decision is made as to their acceptance.

Ohio

State Public Utilities Commissioners at Columbus ruled that neither the Cleveland city administration nor council can protest against the proposed raise in rates the Cleveland Telephone Company has announced for January 1.

This means that unless telephone users file a protest the raise in rates goes into effect without opposition.

F. W. Ballard, who was to be the city's expert in the case, and William Woods, assistant city law director, were before the commission when the company put in arguments in favor of the raise through Allard Smith, general manager, and S. T. Tolles, attorney.

They submitted charts showing how the company's equipment, number of calls and operators had increased in the past few years.

Tolles said measured service is the only way in which Cleveland can get better service.

"Service is bad now, but it is as good as can be given under the present system," Tolles told the commission. "There can be no considerable improvement until measured service is installed. Between 30 and 40 per cent of the company's equipment is now used in useless talk.

"The company has never been an earning organization and since last June it has been operated at a loss. Improvements made the last few years have caused the company to borrow $3,000,000 and it now plans to spend $3,500,000 more to install measured service.

"By 1927 the company plans to spend $25,000,000 in extending its equipment to meet the needs of the city."

Smith told of increase in expenses in the last few years, and the difficulty of getting operators.

"One-third more calls are made in Cleveland than in other cities that have measured service," said Smith. "Equipment and operation are now twice as expensive as in 1913.

"Good service at reasonable rates is the aim of the company."

Woods argued that the city should have the right to be heard, but that by being present it didn't waive its rights to fix phone rates itself.

A request that the Ohio utilities commission grant the Cleveland Telephone Company permission to increase its rates was forwarded to the state body by the legislative committee of the Consumers' League of Ohio.

The league is an organization of 2,200 women having its headquarters in Cleveland. Emphasis is placed on the wage scale paid by the telephone company and with the view of having increases given telephone company employes, the league urges the increase in rates.

The communication follows:

The Consumers' League of Ohio, an organization of 2,200 women, a branch of the National Consumers' League, of which Secretary of War Newton D. Baker is president, respectfully presents the following statement for your consideration.

The league wishes to indorse the demand of the Cleveland Telephone Company for higher rates. We feel that in war-time the telephone service should be the best possible, and we wish to state our firm belief that efficient service depends on an adequate wage scale.

The Cleveland Telephone Company has very kindly given us its wage schedules. Its wage scale is low, especially in consideration of the present high cost of living.

The league, therefore, hopes that you will grant the telephone company the increase in rates, with the understanding that

a suitable proportion of such increase shall be applied as soon as possible to raising the present wage scale.

A novelty of the situation was a resolution asking the Cleveland Telephone Company to join the city in a petition urging the public utilities commission to suspend approval of the company's new rate schedule.

The measure contemplates the holding up of action by the state commission until the city and the telephone company have an opportunity to conclude their negotiations.

By the same resolution the company is to be asked to present its application for an increase of rates before the city council, together with all facts and arguments substantiating its request, in order that the council and patrons of the company may have an opportunity to consider them.

Advisability of such action was urged by Law Director FitzGerald because the commission has intimated it will let the rates go into effect January 1.

"The Cleveland Telephone Company, through its attorneys, has stated a willingness to present to the city all the evidence on which it bases its contention for a raise in rates," the law director said. "This resolution will afford it an opportunity to do so."

Another resolution introduced by Councilman Gahn calls upon the utilities commission to reverse its ruling that the city cannot be given a hearing to protest its contention for a raise in rates.

"The city is the largest individual telephone user in Cleveland," Gahn said, "and it would appear decidedly arbitrary to bar it from presenting its opposition to a rate increase."

Mayor Biehl of Galion has received and submitted to the Chamber of Commerce the finding of the public utilities commission of Ohio in the matter of the joint petition for the merger and interchange of toll business of the Galion Telephone company and the Central Union Telephone company. Permission is given to purchase and sell certain telephone property and to enter into contracts with each other to enable the interchange of toll business. Pending the unification of the two properties the present charges for service are to be maintained. The new rates follow:

SECTION 1. The classification and rates provided in this section apply at any point within the corporation limits of Galion. The rates quoted are yearly:

Business, individual line, primary station, $39.00.
Residence, individual line, primary station, $27.00.
Residence, two-party line, each primary station, $21.00.
Private branch exchange, trunks, each $39.00.
Private branch exchanges, stations, each $15.00.

SECTION 2. Service to applicants at points outside city limits and within 150 feet of any existing rural circuit connected with Galion exchange, at the rate provided for such purpose, plus the rate provided for the distance beyond the corporation limits, measured air line:

Individual line, each quarter mile or fraction thereof, $6.00.
Two-party line, each quarter mile or fraction thereof, $3.75.
Private branch exchange trunks, each quarter mile or fraction thereof, $6.00.

SECTION 3. Rates apply at any point outside the corporation limits of Galion, and within 150 feet of any existing rural circuit connected with the Galion exchange of the company:

Business, ten-party line, each station, $27.00.
Residence, ten-party line, each station, $21.00.

SECTION 4. Extension telephone (within same premises) will be furnished to any applicant having service under section one or three:

Business, each station, $15.00.
Residence, each station, $9.00.

A discount of 25 cents per month is allowed from each of the rates provided in sections one, three and four thereof, if bills are paid monthly or quarterly in advance at the office of the company on or before the 15th day of the month in which payment is due.

Free service between the Galion subscribers of the Galion Telephone Company and the Iberia, Johnsville, New Winchester and West Point Companies which operate separate exchanges at these points.

The Central Union Telephone Company receivers are authorized to sell and convey to the Galion Telephone Company the property in and about Galion, and upon the acquisition of said property the Galion Telephone Company may charge the rates fixed by the commission upon the unification of said properties and the provisions of said additions and extensions ordered. Both companies are authorized to establish a physical connection between their respective systems and to interchange toll service as provided by law.

As soon as the applicants (both companies) file with the commission schedules providing for their respective withdrawal from and inauguration of service within said territory and for interchange service, the authority herein granted may be exercised.

It is ordered by the commission that nothing in its findings shall be construed as a consent to or approval of any diminution of service now enjoyed by the public within the territory now served by means of said property, nor as a finding by the commission that the service of said parties is adequate, efficient or sufficient.

The Ohio State Public Utilities Commission has ruled that its permission was not necessary for the Cincinnati and Suburban Telephone Company to issue $1,121,700 of stock. It is for the capitalization of the over-the-river properties.

Oklahoma

"It is therefore ordered that the company furnish adequate local and toll service and accord courteous treatment to its patrons." That is the major part of the order of the Corporation Commission of Oklahoma in the case of Judge M. M. Alexander et al against the former Pioneer Telephone and Telegraph Company, now the Southwestern Telephone and Telegraph Company, owners of the telephone service in Okmulgee county.

The commission's review of the hearing states that the "testimony shows the service to be very unsatisfactory due to inattention or carelessness on the part of the company's employes in giving wrong numbers, false 'don't answer' reports and 'line busy' reports; delay on part of operators in answering calls and in taking down connections; interruptions in service by operators breaking in on conversations and long delayed completion of toll calls and improper attention to service complaints and discourteous treatment of patrons."

The review further states that "Inadequate wages and long hours of service for operatives was urged by complainants as among the principal causes of poor service," and further that "the company admitted that wages had not kept pace with the increased cost of living."

The news in the commission's report is as follows: "Better wages and shorter hours of service have both been provided by the company since the close of the hearing and there appears to be no justifiable reason why the people of Okmulgee should not have satisfactory service."

The complete finding of the commission is as follows:

In this case citizens of Okmulgee, patrons of the Pioneer Telephone and Telegraph Company, complain of the service rendered by the telephone company in Okmulgee and seek to require the company to either furnish efficient and satisfactory local and toll service, or to reduce its rates commensurate with the poor quality of service now rendered.

The testimony introduced at the hearing in Okmulgee on September 17, 1917, shows the service to be very unsatisfactory due to inattention or carelessness on the part of the company's employees in giving wrong numbers, false "don't answer" and "line busy" reports; delay on part of operators in answering calls and in taking down connections; interruptions in service by operators "breaking in" on conversations and long delayed completion of toll calls and improper attention to service complaints and discourteous treatment of patrons.

The company admits that its service has been poor, but states that it has and can obtain sufficient and efficient help; that the trouble with the service is mainly due to abnormal traffic demands made upon its present over-taxed equipment and other ill suited equipment temporarily installed to tide over and relieve conditions until the completion of its new plant now in process of construction.

The commission recognizes that the company is unquestionably entitled to some consideration owing to its inability to promptly obtain proper equipment, by reason of conditions beyond their control. The testimony, however, indicates that the chief trouble experienced by patrons is due to inefficient operation, and that much could have been done and still can and must be done by the company to afford relief to its patrons from the intolerable conditions complained of. Standard operating methods should be employed.

The alternative suggestion in the complaint that lower rates be established commensurate with poor service will not be considered seriously, inasmuch as the complainants testified that they would not be satisfied with poor service at any price, and the company's representatives testified that they can give the service.

Inadequate wage and long hours of service for operatives was urged by complainants as among the principal causes of poor service.

The company admitted that wages had not kept pace with the increased cost of living; but better wages and shorter hours of service have both been provided by the company since the close of the hearing, and there appears to be no justifiiable reason why the people of Okmulgee should not have satisfactory telephone service.

It is, therefore, ordered that the company furnish adequate local and toll service and accord courteous treatment to its patrons.

It is further ordered that the company prosecute diligently the work of rebuilding its plants and in facilitating the "cut over" to its new equipment, at which time it will be in a position to furnish standard service, more economically and under less trying circumstances than at present.

Minnesota

In the matter of switching fees to be charged on business between the toll lines of the Northwestern Telephone Exchange Company and the local exchanges of the Fulda Telephone Company; this case was brought about by reason of complaints from citizens of Heron Lake and Brewster, Minnesota, because the Northwestern Telephone Exchange Company disconnected its toll lines from the exchanges of the Fulda Telephone Company at Heron Lake, Rushmore, Storden, Westbrook and Brewster, on September 1, 1915.

Upon consideration of the facts in this case, the commission is of the opinion that the existing connections between the toll lines of the Northwestern Telephone Exchange Company and the exchanges of the Fulda Telephone Company should be maintained and that for the purposes of this case and without prejudice, the basis of settlement between the companies should be upon the basis of 5 cents for each incoming and outgoing message until such time as this Commission upon complaint or upon its own motion shall have determined after an investigation that some different rate of compensation should apply to different classes of exchanges or to the particular exchanges affected by this case.

It is therefore ordered that the connections now existing between the toll lines of the Northwestern Telephone Exchange Company and the exchanges of the Fulda Telephone Company, located at Heron Lake, Rushmore, Storden, Westbrook, and Brewster, be maintained, and that the Northwestern Telephone Exchange Company pay to the Fulda Telephone Company for the handling of its toll business at those points, 5 cents for each originating message, and 5 cents for each terminating message passing over the lines of the Northwestern Telephone Exchange Company.

The application of the Tri-State Telephone & Telegraph Company for authority to purchase the telephone property of the Minnesota Rural Telephone Company, a corporation, with its principal office at Princeton, Mille Lacs county, came on for hearing before Supervisor of Telephones J. W. Howatt, at the office of the commission on Friday, November 30, 1917.

The Minnesota Rural Telephone Company is a corporation operating a local telephone exchange within the village of Princeton, and two rural lines radiating therefrom, with certain other rural lines connected therewith. Its exchange is connected with the toll lines of the Northwestern Telephone Exchange Company.

The Princeton exchange of the petitioner now serves 372 stations within the village of Princeton, 37 rural stations on rural lines, which are owned by the petitioner, and 288 connecting company rural stations, making a total of 697 stations. The Minnesota Rural Telephone Company serves 76 stations within the village, 39 rural stations on rural lines owned by the respondent company, and 281 connecting company rural stations, making a total of 396 stations. Within the village, 58 subscribers now subscribe to the service of both companies, and there are but 18 telephones of the Minnesota Rural Company within the village of Princeton, which are not now duplicated by the Tri-State Company. The petitioner proposes to consolidate the two exchanges, which consolidations will permit the parties having duplicate service to eliminate one telephone. The present Tri-State subscribers will have access to 337 additional stations and the Minnesota Rural subscribers will have access to 638 additional stations. The rates for local exchange service within the village of both companies are the same and there will be no increased cost to the subscribers by reason of the consolidation.

Practically all of the stock of the Minnesota Rural Telephone Company is held by several rural companies now connected to the exchange of the Minnesota Rural Telephone Company, each rural company choosing from its members, a director to represent them. A meeting of the directors of the Minnesota Rural Telephone Company was held in Princeton, Minnesota, on November 10, 1917, at which time the sale of their property to the Tri-State Telephone & Telegraph Company was duly authorized. The sale price agreed to between the parties interested in this case was $6,900. The petitioner assumes all contracts outstanding and unexpired entered into by the respondent for the connection of subscribers on rural and toll lines of connecting companies.

In view of the facts in the above case, the commission is of the opinion that the public of the village of Princeton and vicinity will be greatly benefited by the consolidation of the telephone properties by reason of all telephone users in the community being served by one company.

It is therefore ordered that the Tri-State Telephone & Telegraph Company be authorized to purchase from the Minnesota Rural Telephone Company, all of its physical telephone property; also that all rural and toll line connections now existing with the Minnesota Rural Telephone Company shall be continued by the Tri-State Telephone & Telegraph Company.

The Standard Telephone Company is a corporation organized under the laws of the states of Minnesota and Iowa, with its headquarters at Waukon, Iowa. It operates a system of toll lines and exchanges in Iowa and Minnesota, and particularly exchanges at Preston and Caledonia, Minnesota, with toll lines connecting these and other points. The present rates in effect at Preston are as follows:

Individual line, business, $1.50 per month.
Individual line, residence, 90 cents per month.
Four-party line, residence, 90 cents per month.
Rural connecting companies, $1.00 per station per annum.

The petitioner requests authority to place into effect the following schedule:

Individual line, business, $2.00 per month.
Individual line, residence, $1.25 per month.
Two-party line, residence, $1.00 per month.
Multi-party, rural, $1.25 per month.
Extension stations, 50 cents per month.
Rural connection companies, $3.00 per station per annum.

The petitioner filed exhibits covering a valuation of the Standard Telephone Company's property at Preston, showing a reproduction cost new, of $14,776.99, and a present or structural value of $13,461.56. This valuation was checked by the Commission's engineer, who found the reproduction cost new, to be $12,969.24, and the present or structural value to be $11,412.81. The exhibits of the petitioner pertaining to the earnings and expenses of the company for the year ended June 30, 1916, were checked by the Commission and showed the gross earnings of the company for that period at Preston to be $4,125.25, expenses $2,766.35, taxes $123.75, leaving a net operating income of $1,235.15, with which to meet depreciation, return on the investment and surplus. This amounts to a return of 9.175 per cent, to provide for depreciation, and a return on the investment based on $13,461.56, the company's claimed present value of the property, or 10.821 per cent on $11,412.81, the present value found by the Commission's engineer.

During the period from March, 1914, to May, 1915, the company re-built the entire exchange, replacing old equipment with new and modern facilities, replacing aerial wire with aerial cable, placing the plant on an up-to-date basis and in condition to furnish a very good class of service. At the time this case was being considered the telephone company had in service 69 business telephones, 172 one-party residence telephones, 38 four-party residence telephones, one extension telephone, making a total of 281 stations within the village. In addition to this, the company furnished service to twenty rural companies, serving 202 stations on twenty-one circuits. The company operates no rural line of its own.

The company estimates gross earnings of $5,404.05 under the proposed rates; operating expenses, $3,340.35; uncollectible accounts, $108.08; taxes, $185.72, leaving a net operating income of $1,769.90, which would produce 13.142 per cent for depreciation and return on the investment on the company's figure for present value of the property and 15.5 per cent on the present value of the property arrived at by the Commission's engineer. The company's estimate of revenue under the proposed rates is based on an assumption that there will be a loss of ten residence subscribers if the proposed rates were put into effect; that a change in the clasification of service will be effected, reducing the number of individual line residences telephones from 172 to 25, the remaining 176 to come under the two-party classification. The commission cannot agree to this classification of service for the reason that past experience shows that a reasonable increase in the rate for residence service does not have the effect of reducing the number of subscribers using the one-party service to the extent indicated by the company's estimate. It would appear more nearly reasonable to assume that there would be at least fifty individual line residence stations, leaving 151 stations under the two-party residence service. Using this classification of 69 business telephones at $2.00 per month, 50 one-party residence at $1.25 per month, 151 two-party residence stations at $1.00 per month, one extension station at 50 cents per month, and 202 connecting rural stations at 25 cents per month, would bring the gross earnings to $5,479.05.

Corrections and adjustments suggested will produce a net operating income of $1,606.82 to provide for depreciation, return on the investment and surplus, or 17.07 per cent on the Commission's present value of $11,412.81.

It is therefore ordered that the Standard Telephone Company be permitted to charge the following reasonable and maximum rates for telephone service at its Preston exchange, the same to be effective January 1, 1918:

Individual line, business $2.00 per month.
Individual line, residence, $1.25 per month.
Two-party line, residence, $1.00 per month.
Extension stations, 50 cents per month.
Multi-party rural (company owned), $1.25 per month.
Connecting company, rural, $1.50 per station per annum.

The application of the Canby Telephone Company for authority to increase its local exchange rates at Canby, Porter and St. Leo, Minnesota, was heard at Canby, Minnesota, on December 1, 1916. No one appeared to protest against the petition.

The Canby Telephone Company was organized in 1915 and is the successor of the Farmers' Mutual Telephone Company, which company was sold at sheriff's sale, January 4, 1915. The property of the Farmers' Mutual Telephone Company was purchased by the petitioner for $9,000, plus an indebtedness to the bank of $5,264.83, or a total price of $14,-264.83. The stockholders of the Canby Telephone Company were interested in the original company. The Canby Telephone Company has a capital stock of $14,400.00, which is held by twenty-four stockholders, each holding $600.00 worth of stock. The company operates local exchanges at Canby, Porter and St. Leo, together with numerous rural lines in the vicinity of each exchange. The plant consists of approximately 315 miles of pole line, carrying 630 miles of wire and a small amount of aerial cable. The alleged original cost of the property is $37,000.00. The petitioner now, and since the organization of the company, furnishes service to all of its subscribers at the rate of $1.00 per month.

At Canby the company furnishes services to 34 business stations, 7 residence stations and 118 rural stations.

At Porter, 16 business stations, 11 residence stations and 144 rural stations.

At St. Leo, 6 business stations, 5 residence stations and 61 rural stations.

Of the 144 rural stations listed under Porter, there are included 30 stations receiving service in the vicinity of Taunton and Minneota. Investigation of such books and records of account as are maintained by the Canvy Telephone Company was made by the statistician of the commission. The records were found to be in distressingly poor condition. The company has never paid a dividend or set aside a reserve for depreciation. It has never made enough money to hire a bookkeeper and such records as they have are kept by the secretary, who is a farmer, and whose knowledge of bookkeeping is extremely limited. The company has been very economically operated, employing but one lineman to maintain the entire property, one operator at each exchange, and the officers of the company receive no salary whatever, except a per diem of $3.00 when attending directors' meetings, held three or four times each year. For the year 1915, the company's operating revenues amounted to $4,618.68; operating expenses, $4,937.82; taxes, $175.23; interest on loan, $9.99, causing a loss of $504.36, to offset which, they borrowed $500.00 from the bank, $400.00 of which they still owe. For the eleven months of 1916, the operating revenues were $4,759.96, the expenses, including taxes and interest on loans, $3,868.60, leaving but $891.36 to provide for depreciation and return on the investment. Estimated revenues at the three exchanges, based upon the present number of subscribers and the proposed rates, would amount to $6,649.00, which includes $553.00 as commissions received from connecting toll companies. The total expenses on the 1916 basis would amount to $3,638.86; taxes, $199.47, leaving a net revenue of $2,810.67.

Although no inventory of the plant has ever been taken, calculations based on the plant measurements testified to in this case would clearly indicate that the plant could not be built for less than $37,000.00, the original cost claimed by the company. Some extensions have been made to the property since it was acquired by the Canby Telephone Company, but the records do not show how much money was expended for that purpose. Assuming that the property has depreciated to 60 per cent of its original cost, a value of $22,200.00 is arrived at. The estimated net revenue of $2,810.67 under the proposed rates would produce 7.6 per cent upon the company's claimed book value of $37,000.00, or but 12.6 per cent on the assumed value of $22,-200.00, to provide for a return on the investment, a reserve for depreciation and surplus.

Upon review of all the facts in this case, the commission is of the opinion that the application should be granted.

It is therefore ordered that the Canby Telephone Company be permitted to place into effect, as of January 1, 1918, the following schedules of rates:

CANBY

Individual Line, Business	$1.50 per month
Individual Line, Residence	1.00 per month
Rural Stations (company owned)	1.25 per month

PORTER

Individual Line, Business	$1.50 per month
2-party Business	1.25 per month
Residence, 4-party	1.00 per month
Rural Stations (company owned)	1.25 per month

ST. LEO

Individual Line, Business	$1.50 per month
Residence, 4-party	1.00 per month
Rural Stations (company owned)	1.25 per month

It is further ordered that the Canby Telephone Company shall immediately set up a system of accounts and keep its records in accordance with the uniform system of accounting provided by the Commission.

Pennsylvania

The Public Service Commission of the Commonwealth of Pennsylvania, Bureau of Rates and Tariffs, has sent out the following relative to changes in telephone rates in Meadville and other portions of Crawford county, becoming effective January 1, 1918:

The Crawford Mutual Telephone Company, operating in Conneautville, Springboro and vicinity, has filed with the Public Service Commission a new tariff, to become effective on January 1, 1918, which provides for an increase of two dollars ($2.00) in each of the yearly rates except those for extension telephones and extension bells. The new rates are proposed to be made subject to a discount of fifty cents ($0.50) from each quarter's rental, if rental for the quarter is paid within twenty-five days from the first of the quarter for which bill is rendered, or a pro rata discount if rental is paid monthly within ten days of the first of the month for which rental is due and payable.

The Falowfield Telegraph and Telephone Company, of Linesville, Pennsylvania, has filed a new tariff of rates to become ef-

fective on January 1, 1918, which provides for increases in all of the rental rates in that new rates are listed as follows:

One-party business telephone in Hartstown—Yearly, $24.00; monthly, for short terms, $4.00.

One-party residence telephone in Hartstown—Yearly, $15.00; monthly, for short terms, $2.50.

Business telephone—Yearly, $15.00; monthly, for short terms, $2.50.

Residence telephone—Yearly, $12.00; monthly, for short term, $2.50.

Ten per cent penalty added if not paid on or before the 15th of the first month of the quarter.

The Meadville Telephone Company has filed a new tariff of rates to become effective on January 1, 1918, which provides for an increase of from $2.00 to $6.00 per year in the rates for business telephones in Meadville and adjacent rural districts, so that the new rates are as follows:

City of Meadville—One-party business telephone, $36.00; two-party, $30.00. Rural, multi-party, $20.00.

The first complaint to be made by a telephone company that a traction company was not properly guarding power-transmission wires was filed with the Public Service Commission by the South Annville Rural Telephone Company. It is claimed that the Hershey Transit Company has not complied with an order of the commission in regard to certain wires.

The White Deer Telephone Company, operating in Montgomery county and vicinity, has filed notice with the Public Service Commission, of an increase on local calls from 5 to 10 cents.

Virginia

Representatives of the Chesapeake and Potomac Telephone Company of Virginia notified Chairman Garnett, of the state corporation commission, of their intention to petition for increased rates over the state. They were informed that the commission was not in a position to grant the increase until after the legislature meets, as it is probable the plea will have to go before that body.

Wisconsin

As yet the state rate commission has not made its report in regard to telephone rates. A decision is not expected for some months, due to the fact that the rate question, so far as zones is concerned, is being considered in most all of the suburban communities in Wisconsin.

In Caledonia and other adjacent zones the Wisconsin Telephone Company gave notice that its rates would be increased to 25 cents, beyond the five-mile limit.

Many farmers, who are patrons of the company, kicked against this decision on the part of the corporation, declaring that the increase was not warranted in view of the service given and for other reasons.

Formerly the majority of the patrons were patrons of the old Citizens' Telephone Company and declare that when the Wisconsin company purchased and took over the Citizens' company there was an agreement that the Citizens' rates were to hold good.

On the contrary the Wisconsin company claims that at the time of the transfer it was agreed that the Wisconsin company's rates, considerably more, should prevail.

These rates were inaugurated in the city of Racine, but never in the country districts. Those interested in the controversy have been looking up all records in connection with the sale of the Citizens' company property, believing that there was a written agreement as to the rates, but nothing official has been unearthed.

Automatic Telephony in Australia

The New South Wales Postmaster-General has decided to install an automatic telephone exchange in the city of Sydney at an estimated cost of £90,000.

Operators Pledge Loyalty

Operating employes of the traffic department of the Southwestern Telegraph and Telephone Company at an operators' social at San Antonio, Tex., were so deeply impressed with a message delivered by Percy Redmund, general traffic superintendent of the Southwestern Company, that they presented to Mr. Redmund a pledge of loyalty and support signed individually by all San Antonio operators.

This pledge, which has the signatures of about 500 operators, read as follows:

"We, the undersigned traffic employes of the local and long distance departments of the Southwestern Telegraph and Telephone Company of San Antonio, Texas, in this time of National emergency, pledge our loyalty to Mr. Redmund, our company and our country."

Under the supervision of H. B. Whatley and D. M. Parkinson of the traffic department in San Antonio, the young ladies rendered a pleasing program which was followed by an address by Percy Redmund who came to San Antonio to deliver a message to the young lady employes relative to the part they are now taking in the great world war.

In his address he impressed upon his hearers their wonderful opportunity for service to the nation and featured the possibilities they have of service to the government in San Antonio during the time of great encampments in that vicinity.

The feature of his talk was the part that women are playing in the great liberty war and the dependence the nation is putting upon those employed in the great industrial institutions of the country. He said in part: "Woman's help has always been a tremendous factor in creditable accomplishments of men. That is the record of the past and it will be the same in the future.

"The country is depending upon its telephone system and the telephone system is depending upon each one of you. You each have your individual duty to perform and it is important that you do it. Whether you have the wonderful intellectual ability and executive mind of a Woodrow Wilson in the Presidential chair or the courteous personality of a Mary Ann sitting at the switchboard, is a matter which God Almighty has settled for you. All you are answerable for is, have you made the most of what he gave you?"

Bell Salary Increases

A general increase in the salary schedules of several Bell companies is announced. It is understood that the increases will become effective the first of the year. All classes of employes are included. It also is believed the increases will be permanent.

F. H. Bethell, first vice-president of the New York company, says:

"We have, after carefully considering the matter, come to the conclusion that a bonus payment to employes such as was made last year will not meet the situation with respect to living conditions now confronting our employes as well as others.

"Therefore, a plan involving a general increase in pay has been adopted, which increase will, in the aggregate and for the year, more than double the bonus payment of 1916.

"This general increase in wage schedules will in no way affect increases awarded from time to time in recognition of efficient services rendered."

Of Interest to the Trade

What the Telephone and Accessory Manufacturers Are Doing to Advance the Art

Stromberg-Carlson New Wall Telephone

A large two-color folder is now being mailed to the trade by the Stromberg-Carlson Telephone Manufacturing Company in which it advertises a new model of its well known No. 896 wall telephone.

The accompanying illustrations show many of the improvements which have been incorporated in the design and equipment of the new instrument. The cabinet is somewhat smaller than in previous types and it is fitted with a writing shelf which is inclined at the proper angle for writing purposes when the user is standing at the telephone. The depths of the shelf and the transmitter arm are properly proportioned so as to give a plain view of the writing surface while the user is speaking with his lips close to the mouthpiece.

Different Views of the No. 896 Wall Telephone.

The open view of the instrument shows how the usual wooden generator shelf has been eliminated by attaching the generator to the backboard and securing it in proper alignment by means of a rigid metal brace. This improvement diminishes the possibility of breakage in transit, makes the interior more accessible, and facilitates neat wiring of the apparatus.

The bottom of the telephone cabinet on which the dry cells rest is provided with two shallow holes which locate the dry cells and keep them from getting together or against the sides of the cabinet. This improvement prevents short-circuits between the cells and the apparatus mounted on the inner surface of the door.

The wiring of the telephone is accomplished without the use of hinge connections or flexible cords and each wire in the single hand-made cable form is colored so that it may be traced easily from one piece of apparatus to another without testing. The cable contains a universal wiring system which provides for sixteen different kinds of local battery circuit equipments. The telephone may be converted from one class of service to the other without adding or disturbing a single wire in the cable form.

The method of mounting the apparatus also facilitates quick alterations in the equipment. For example, the backboard is drilled for three-, four- and five-bar generators so that the different sizes of generators are interchangeable in all cabinets of this type. This avoids carrying different types of telephones in stock in the purchasers' store rooms as the new telephones are adaptable for many different kinds of service and types of equipment.

One part of the circular describes the Stromberg company's new battery saver with which telephones of this type can be equipped as an additional attachment is ordered.

Further detailed information will be supplied upon request to the main and branch offices of the Stromberg-Carlson Telephone Manufacturing Company.

Civil Service Examination

The United States Civil Service Commission announces an open competitive examination for junior telegraph and telephone engineer, for men only, on January 23, 1918. Vacancies in the Interstate Commerce Commission under the act providing for the valuation of property of common carriers will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The following positions established under the above act will be filled from the register resulting from this examination:

Junior telegraph and telephone engineer, Grade I, $1,200 to $1,680 a year.

Junior telegraph and telephone engineer, Grade II, $720 to $1,080 a year.

In addition to the above salaries necessary expenses will be allowed when absent from headquarters in the discharge of official duties.

Applicants for examination and appointment to either of the above positions are not debarred from taking any other examination to which they may be eligible. A junior engineer in a Grade II position may be

promoted to Grade I upon showing the requisite experience for Grade I positions. A junior engineer in Grade I may be promoted to positions in the senior grade upon passing appropriate noncompetitive examination to meet the requirements of such higher grade.

Appointments to these positions will be principally for field service.

Competitors will be examined in the following subjects, which will have the weights indicated:

	Weights.
1. Theory and practice of telegraph and telephone engineering, including overhead and underground construction, office equipment, and systems of operation, and the mathematics used in this branch of engineering, including algebra, geometry, and trigonometry, but not including calculus	50
2. Education, training, and experience	50
Total	100

Suggestions for Your Show Window

Why are show windows valuable advertising?

Did you ever stop to think of the value of show windows? The up-to-date merchant knows and endeavors to keep a representative line of his goods constantly on display in various forms. Did you ever stop to consider that when you buy some advertising space in your local paper or when you contract with the picture house to

" TELEPHONE FACTS "
WHY TELEPHONE EQUIPMENT COSTS MORE
FOLLOWING ARE COPIES OF PHOTOGRAPHS OF
$3000.00 WORTH OF PLATINUM. A MODERATE SIZED SWITCHBOARD CONTAINS THOUSANDS OF CONTACTS WHICH MUST BE MADE OF THIS METAL
$16.00 WORTH NO. 40 MAGNET WIRE
$5 WORTH TRANSMITTER CARBON

Kellogg "Show Window" Supplies.

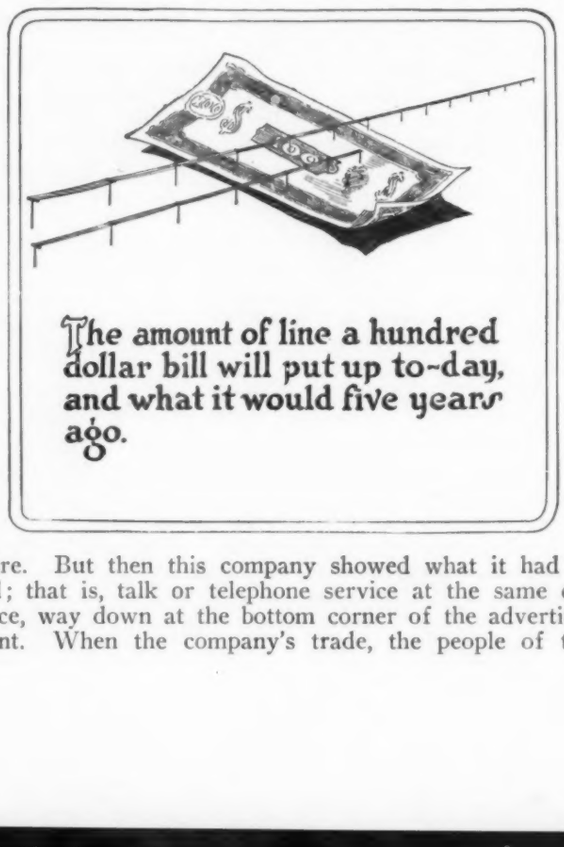
display your slides every evening, that you are, in reality, buying a little "show window" for properly advertising the goods which you sell?

You want to display your wares therein as the merchant does so successfully. Now is the time when you need that "show window" right along and you want to tell the story of your efforts to show what you are selling and how you are trying to do it, whether you are in an immediate need of new subscribers or not. This advertising space in the paper, this "display window" of your telephone company which sells "talk," must particularly at this time, illustrate talk with the price tag.

Your friend merchant does that unless he is catering to a particular trade who tries to pretend they are not interested in prices. Your trade is interested in prices and so, for that matter, is every other trade and every other person or company interested in prices. We all have to be. You can't very easily illustrate talk, but you can in this "show window" of yours illustrate the things you need to sell talk—that is, the apparatus, the switchboards, the telephones and the immense amount of line construction supplies that you must have. People are interested in tangible things, in concrete statements, comparisons, and above all, they are interested in pictures. Therefore, picture your wire as you get it and picture your various supplies as far as practical, and in every case with a price tag. If you show price tags of today and

five years ago at the same time in your "show window" it will interest people, because they too are comparing in their homes the price tags of the things they have to buy today and what they paid for them five years or more ago.

One telephone company made a mighty successful display for its newspaper "show window." It had drawn a pig, a cow, a chicken, eggs, vegetables, flour, apples, coal, corn on the cob, milk, all of the necessaries of life, had them drawn all the way "up in the air." The most illiterate of readers know what that means. The pig and the cow and the corn cob all cost more and a great deal



more. But then this company showed what it had to sell; that is, talk or telephone service at the same old price, way down at the bottom corner of the advertisement. When the company's trade, the people of the

whole town, looked in at this "show window" and saw these things up in the air they knew in a minute what was needed to keep telephone service on a grade that the telephone company wished to keep it and the high class of service which they, the trade, demanded.

So don't close up your "show window" or don't sell it or give it away, but fill it full of your best arguments to fit your needs of the hour, whether it be more subscribers, greater toll business or better rates. You will get all of these things if you keep after them consistently and constantly and you are very liable indeed not to get them at all if you sit back and do nothing.

The Kellogg Switchboard & Supply Company, with the assistance of some of its good customers, has an attractive lot of talk pictures for telephone companies' advertising. They will help you. Send yor your copy of this bulletin today.

General Manager Kansas City Home

H. Lester Harris, formerly sales engineer for the Stromberg-Carlson Telephone Manufacturing Company, has accepted the position of general manager of the

H. Lester Harris.

Kansas City Home Telephone Company and is now in Kansas City taking up his new work.

The wide experience which Mr. Harris has had in both the Bell and Independent branches of the telephone should enable him to discharge the duties of his new position with greatest efficiency. Mr. Harris spent a number of years in the operating field and specialized on traffic studies before he joined the engineering department of the old Dean Electric Company in 1908. Shortly afterwards he was transferred to the sales engineering department of the same company and took up estimating and designing of large multiple switchboards. At the time the Garford Company (successors to the Dean Electric Company) sold its telephone manufacturing business to the Stromberg-Carlson Telephone Manufacturing Company, Mr. Harris joined the organization of the latter company as sales engineer, which position he held at the time he entered the service of the Kansas City Home Telephone Company.

Mr. Harris is conceded to be one of the best posted traffic and operating engineers in the country and the Kansas City Home Telephone Company is to be congratulated upon its wise choice of its managing executive.

Stromberg-Carlson Equipment

The Owensboro Home Telephone and Telegraph Company has placed an order with the Stromberg-Carlson Telephone Manufacturing Company for a complete centrally-operated central energy exchange equipment for its plant at Owensboro, Ky.

The new main switchboard will be arranged for an ultimate capacity of 4,200 lines and will be equipped for present operation with 1,400 central energy local line equipments, 30 toll line equipments and 40 rural line equipments. The cord circuits will be of the most modern type, including the following automatic features: Automatic harmonic party line ringing, flashing recall, automatic operator's cut-in and cut-off, automatic busy test and automatic peg count.

The installation will also include a full complement of terminal and distributing frames, storage battery plant, power board, charging and ringing machines, chief operator's and wire chief's desks, etc.

Platinum Scarcity and World's Output

Platinum has increased greatly in price since the war started and many substitutes have been attempted. One explanation for the increased cost is the reduction in the output of the world as shown in the following table, where the figures represent troy ounces.

Country	*1915*	*1916*	*1917*
Canada	30	100	60
Colombia	17,500	18,000	25,000
New South Wales and Tasmania	1,248	303	222
Russia	241,200	124,000	63,900
United States	570	742	750

In 1916 the crude platinum mined in Colombia, estimated at 25,000 ounces, was refined in the United States, and reports received from domestic refiners show that 28,088 ounces of metals of the platinum group were recovered by them from all sources, foreign and domestic, of which the bulk, 24,519 ounces, was platinum. Borneo and Sumatra produced 200 ounces in 1913, but no figures are available since that date.

Advertising in Association Publications

At a meeting of the Chicago Trade Press Association, held in the City Club, Chicago, November 13, 1917, the following resolution was adopted unanimously, and the secretary was instructed to send a copy of the resolution to each member and to all the periodicals published in the interests of clean advertising, and also to supply a sufficient number to Secretary Neal of the Associated Business Papers, Inc., so that a copy could be given to each of its members:

ADVERTISING IN ASSOCIATION PUBLICATIONS.

Whereas, Some associations of business men are permitting the influence of their organizations to be used to beg and bulldoze members of their trades to give advertising to their association publications, generally without pecuniary profit to anyone but the solicitor,

Resolved, That the Chicago Trade Press Association do hereby condemn such mendacious solicitations as an undignified perversion of association influence, far removed from the original purpose of any business organization, and a deceptive masquerading of false charity under the attractive cloak of legitimate adverising.

Stromberg-Carlson Exchange

The Farmers' Independent Telephone Company of Red Cloud, Nebraska, has been making a splendid record of progressive development in its territory and to make way for more operations and better service, has contracted with the Stromberg-Carlson Telephone Manufacturing Company for a new centrally-operated exchange equipment.

The new switchboard will be of the Central Energy lamp signal multiple type equipped for both local and rural service. To this end the various operators' positions will be equipped with universal cord circuits which will automatically adapt themselves to the classes of connections established. All positions of the switchboard will be equipped for harmonic party signalling.

Orders have been placed with the Stromberg-Carlson Company for the necessary power, battery, and terminal frame equipment for the new board, likewise for a large number of central energy telephone instruments for use when the cut-over is made sometime during the coming summer.

Radiophone Fog Warning Device

A radiophone fog warning device has been installed at the Point Judith light, near Newport, R. I.

The apparatus will be of use to commanding officers in picking up the light in thick weather, as experience has shown that operators can judge to some extent the distance according to strength of signals with a known normal range. Although measurements have been taken to determine the limit of the range of this apparatus, too much reliance should not be placed in it until its worth has been proved under service conditions.

The apparatus will be in operation during fog, mist, rain and falling snow. The warning consists of the repeating of the words, "Point Judith Light," every five seconds, with limit of range of about eight miles. After every third repetition the warning, "You are getting closer; keep off," is sent out with a limit range of about two miles.

The apparatus required for the reception of the warning signals is an ordinary radio receiver, says *The Wireless Age*. Crystal detectors may be used. The wavelength is varied continuously between 550 and 650 meters.

The system is yet in its first stages and it will doubtless be improved in the course of actual practice. The fact has been pointed out that before long every lighthouse will be shouting its name and other information so that the illumination will become of secondary importance.

Telephone Lunch Room Saves Sugar

At the Milk Street lunch room of the Boston telephone system, 2,000 pounds of candy were sold each month in penny purchases, made by girl telephone operators after lunch—and this is only 1 to 12 such lunch rooms throughout the Boston telephone system. When the United States Food Administration asked for conservation in sugar, the lunch-room manager of the company, E. H. Ansell, called upon operators to save sugar by satisfying the sweet tooth with the following commercial confections, made largely from honey, maple sirup, molasses, and corn sirup: Chocolate-covered honey nougatines, molasses chips, maple walnuts, peanuts, old-fashioned molasses candy, molasses gems, raspberry jelly, coffee jelly, peanut butter, marshmallow walnuts, toasted marshmallows, cocoanut cakes, corn cakes. Two days a week no white bread is served to the 1,800 operators who eat in these telephone lunch rooms, substitutes being golden-flour bread, rye bread, rye muffins, oatmeal muffins, bran muffins, and bran doughnuts, with mashed potatoes or rice as a substitute for toast in the service of creamed fish and fried chicken. Mr. Ansell is a member of the staff of Frank C. Hall, who has charge of food conservation in hotels in New England under the United States Food Administration.

Engineers to Assist Government

An unqualifiedly successful meeting of the American Association of Engineers was held in Washington, D. C., on the evening of December 14. During the present critical period when patriotism and co-operation are the main issues, the association is working with full power to enable our government to secure desirable and qualified technical engineers.

Among those present were Admiral F. R. Harris, chief of the Emergency Fleet, Admiral Bird, Major Zimmerman of the Engineers' Depot and Major Harrison. A vivid description was given by Captain D. S. Hays, Engineer Corps, U. S. A., for the National Association, informing how the organization rose from small beginning, struggled, and finally overcame all obstacles, attaining its present success and how the war work was being handled so effectively. Several others responded with enthusiastic toasts. The following were elected officers of the Washington Chapter:

F. R. Weller, consulting engineer, president.

A. S. Grossberg, chief designer, Bureau Yards and Docks, first vice-president.

Harry Stevens, consulting engineer, second vice-president.

Captain D. S. Hays, Engineer Corps, U. S. A., secretary.

O. M. Sutherland, mechanical engineer, Bureau Yards and Docks, treasurer.

The total number of members in Washington to date is one hundred. The association is a member of the Chamber of Commerce of the United States of America and is co-operating with all the Chambers of Commerce throughout the country, for it is believed the maximum benefit to the technical profession and our government will be realized when the engineers are working hand in hand with business organizations.

Washington Places Wire Embargo

The first war-time embargo on telephone messages in the District of Columbia has become effective and requests on operators for the time, for baseball, football or other sporting results will have to be discontinued.

In an announcement recently the Chesapeake and Potomac Telephone Company declared that unless this step was taken the company could not render the efficient service necessary to war-time conditions.

In Washington alone the company estimates operators are asked clock time thirteen thousand times a day.

From now on individuals seeking to ascertain the location of fires, the outcome of sporting events and the time will not be able to obtain this information from operators.

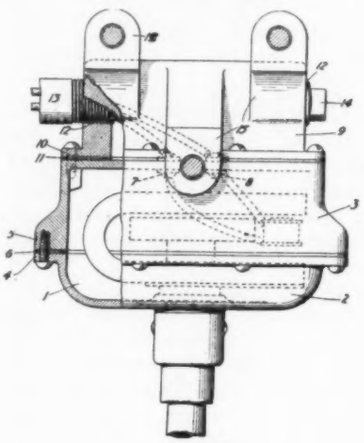
Telephone traffic in Washington to-day is flowing 50 per cent above normal, creating a telephone situation most difficult to handle, according to the company.

Inventions in the Telephone Field

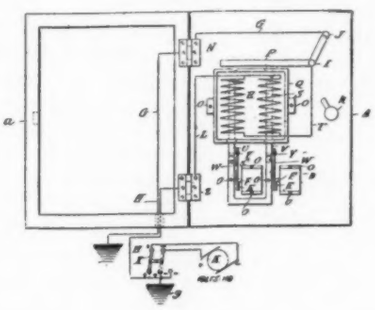
A Brief Digest of Current Patent Specifications Most Interesting to Telephone Men

BY DAVID S. HULFISH

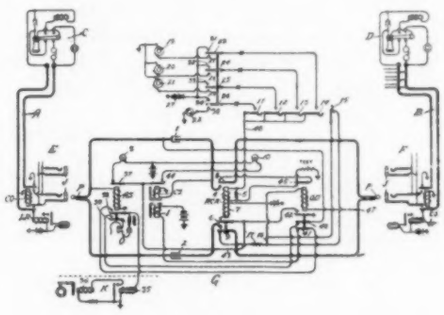
NO. 1,232,496. Call-Distributing System. Issued to H. P. Clausen, assinor to Western Electric Company, Inc., New York, N. Y. An automatic switch distributes calling lines to answering jacks.



1,232,515.



1,232,891.



1,233,196.

1,232,497. Manual Exchange Circuit. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. After a time limit has passed, a signal is given to the operator in case the call has not been answered.

1,232,498. Automatic Testing System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York. A set of relays test a line and signal any irregular condition upon the tested line, and a moving automatic switch tests the lines of an exchange in rotation.

1,232,515. Waterproof Receiver Case. Issued to H. C. Egerton, assignor to Western Electric Company, Inc., New York, N. Y. A receiver magnet and operating spool are in a water-tight case, the wires pass through water-tight inlets, and sound is given to a flexible tube ending in an earpiece.

1,232,580. Selective Controlling System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. A system for controling the connections between a call-sender in an automatic system and the successive automatic switches which the callsender is required to adjust.

1,232,581. Telephone Set. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. An automatic callsender operates directly upon the springs of the hook-switch, one set of springs thus serving for both hookswitch and callsender.

1,232,891. Call Register. Issued to G. I. Bruschke, Chicago, Ill. Two counting meters are provided, either of which may be operated, the meter operated depending upon the polarity or direction of the current.

1,233,196. Cord-Pair Circuit. Issued to H. D. Currier, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. Automatic ringing is provided for, ringing until the party answers, and an arrangement of relays prevents the operator from listening upon the connection after the party has answered.

1,233,766, 1,233,767, 1,233,768 and 1,233,769. Loading Coils and Circuits. Issued to Lloyd Espenschied, assignor to American Telephone & Telegraph Company, New York, N. Y. The loading coils and circuits are arranged to load both of the two physical circuits of a phantom line and to load the phantom circuit also.

1,233,830. Semi-Automatic Exchange. Issued to J. L. Wright, assignor to Western Electric Company, Inc., New York, N. Y. Upon lifting the receiver the calling line is connected to an operator; by the first action of the operator in sending the call through automatic switches the speaking circuit is interrupted. Two switches are used to reach the operator, one for selecting the line and one for selecting the operator.

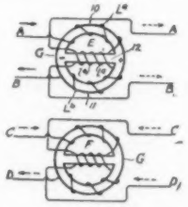
1,233,831. Iinefinder Circuit. Issued to A. H. Adams and A. E. Lundell, assignors to Western Electric Company, Inc., New York, N. Y. A single relay is used first to start a linefinder switch when the relay is charged, then to continue the movement of the switch while the relay is discharged, then to stop the movement of the switch when the relay is charged again by the finding of the calling line.

1,233,837. Semi-Automatic. Issued to J. D. Bonnar, assignor to J. R. Garfield, trustee, Cleveland, Ohio. In a double-linefinder system, a first switch finds the calling line, a second switch searches and finds the first switch and a third switch permanently connected with the second switch then finds an idle operator's set.

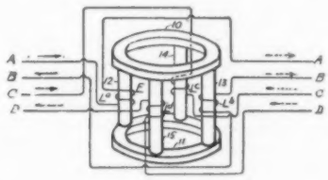
1,233,870. Linefinder Circuit. Issued to C. L. Goodrum, assignor to Western Electric Company, Inc., New York, N. Y. Where a starter circuit passes through successive linefinder switches, means is provided to keep the starter circuit closed during the operation of restoring the switches.

1,233,891. Selector System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. The impulses for stepping a selector switch in search are given by a series of relays, each of which closes circuit for the next.

1,233,893. Reverting Call System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York. While a line is operating a selecting switch, the busy test is taken off of the line, so that should the line select its own number the busy will not be encountered; thus a reverting call, or a call for another station upon the same party line, may be made.



1,233,767.



1,233,769.

1,233,940. Relay Linefinder. Issued to H. G. Webster, assignor to Western Electric Company, Inc., New York, N. Y. A linefinder is composed entirely of relays, in groups of "tens relays" and "units relays," and auxiliary relays prevent interference between the relays of a linefinder in case two lines should call at the same time.

American Minister Ira N. Morris reports from Stockholm, Sweden, that a royal decree has been issued increasing intrastate telephone and telegram rates.

Chicago Labor Asks Federal Control

Chicago organized labor stands pledged to the federal unification of telephone and telegraph lines as a means to get 15,000 trained men needed for the army signal corps without creating an after-the-war surplus of such workers.

A letter sent to Secretary of War Baker and signed by virtually all Chicago labor representatives, said:

"We know maintenance of many separate and duplicate systems of electric communication, owned and operated by conflicting interests, prevents the release of these experienced men needed in the army.

"Large electrical manufacturing companies now are at work making duplicate telegraph and telephone equipment for companies seeking to outstrip competitors during the war.

"For this reason some manufacturers do not desire government work.

"An abundance of duplicate equipment exists furthermore, and all this surplus of men, material and equipment could be released without impairing the service needed here.

"A simple solution of these problems, we believe, would be to unify the entire network of telephone and telegraph systems of the country for the period of the war, to be handled by the government, assisted by an advisory board consisting of representatives of the telephone and telegraph companies and of the telephone and telegraph workers, chosen through their organizations, which would be recognized by this board.

"This board would be authorized to unify, co-ordinate and jointly operate all the lines.

"It would also be authorized to control extensions and improvements, to delay them until conditions become normal, that experienced workers may be assured protection and steady employment during the period of reconstruction after the war ends.

"If this suggestion is deemed worthy of further discussion we would ask you to consider calling a conference."

Bell Employe Buys Independent

Sale of the Port Arthur, Texas, telephone exchange and other properties for a consideration of $165,000 was consummated December 21, the deed having been filed for record in the county clerk's office at Beaumont. The sum of $65,000 was paid in cash, the remainder being represented by notes.

P. K. Higgins of Port Arthur, long known as a Bell employe, is shown in the deed as the new owner of the telephone properties, which were sold to him by the Texas Long Distance Company, of which J. B. Earle served as president and E. C. Blomeyer as secretary. All of the properties, including the exchange building and land on which it stands, the wires, poles, switchboards and franchise are all included in the sale.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL NOTES.

Silas A. Price, president and general manager of the Dundee Telephone Company, New York, died at the Hahnnemann Hospital in Rochester December 11. Mr. Price was born at Altay, a few miles from Dundee on February 2, 1846. He lived at that place until about twenty years of age, when he went to Michigan, where he remained for eight or nine years. He then returned to the village of Wayne, where he conducted a drug store for several years. Later, he went to Dundee, where he operated a drug store and telegraph office for twenty-one years. In 1903, Mr. Price purchased a controlling interest in the Dundee Telephone Company, and since that time he has been its president and manager. He operated the first telephone and telegraph office in the village of Wayne about thirty years ago.

T. N. Moore, assistant to the commercial superintendent of the Wisconsin Telephone company, with headquarters in Milwaukee, has been named district manager with headquarters in Madison. He succeeds C. L. Miller.

Timothy F. Desmond, of Cambridge, Mass., traffic and plant division of the New England Telephone & Telegraph Company, has been appointed an inspector in the telephone and telegraph bureau of the Massachusetts Public Service Commission.

Edward Price, of Ripley, Ontario, has been appointed superintendent of plant for the Home Telephone Company, Ltd., of Markham, and will assume charge shortly after December 1. Mr. Price has had charge of the municipal telephone system of Ripley for two years and was with the municipal system at Chinquacousy, Ontario, Canada, for five years.

A. V. Grimes, manager of the Eldorado branch of the San Angelo, Texas, Telephone Company, has purchased from A. O. Beavers, of Eldorado, a half interest in the exchanges at Wingate, Runnels county, and Hylton, Nolan county.

E. L. Harmon, Mineral Point, Wis., former owner of the Mineral Point Telephone Company, has purchased the New Union Telephone Company which operates exchanges in Dodgeville and Highland and has taken possession of the properties.

J. K. Stitt, local manager for the Central District Telephone Company, Upper Sandusky, Ohio, has been transferred to Oil City, Pa., where he will have charge of the Franklin and Titusville, Pa., exchanges, in addition to that at Oil City.

W. W. Davis, formerly assistant auditor for the West Texas Telephone Company in Brownwood, Texas, has been made auditor for the Gulf States Telephone Company at Tyler, Texas.

J. R. Shipley, manager of the Fredonia, Kansas, Telephone Company, has severed his connections with that company to go with the Port Arthur Telephone Company, Port Arthur, Texas.

J. A. Gustafson, of the telegraph department of the Missouri Pacific Railway Company, has succeeded Mr. Shipley as manager of the Fredonia Telephone Company.

Roy F. Mapes, local manager for the Citizens Telephone Company at Battle Creek, Mich., has been made secretary-treasurer of the Michigan Independent Telephone and Traffic Association, succeeding F. V. Newman, who recently went with the Indianapolis Telephone Company.

Julius Andrae, well known in the field as one of the pioneer telephone manufacturers and founder and president of Julius Andrae & Sons Company, Milwaukee, Wis., died suddenly at his home in that city on his 88th birthday anniversary.

H. W. Day, local manager for the West Texas Telephone Company, Ballinger, Texas, has been transferred to the headquarters of the company in Brownwood.

A. T. Duvall, for the past two years connected with the engineering department of the Central Home Telephone & Telegraph Company at the Louisville, Kentucky, offices, has entered the federal service in the ordnance department and has been assigned to duty at Washington, D. C. Mr. Duvall makes the tenth Central Home man who has entered the service.

George H. Crandall recently tendered his resignation as secretary and general manager of the Stephenson County Telephone Company of Freeport, Ill., effective December 1. Mr. Crandall is well known among Independent telephone men of Illinois and Texas.

On Sunday, November 3, the electrical world lost one of its ablest workers in the person of William Duddell, who passed away at the early age of 45. Born in London in 1872, Duddell was destined to become one of the leading

figures in modern electrical development; and early in his career he developed his ingenious oscillograph for the study of alternating current wave forms. Some time later he conducted an exhaustive and highly interesting series of experiments on the direct-current arc, and it was during these experiments that he evolved the musical or singing arc which he found to act as a generator of high-frequency current. In recent years wireless investigators have made use of Duddell's musical arc in the development of wireless telephony and long-range wireless telegraphy, and Duddell himself turned his attention to wireless, developing remarkable instruments for detecting weak electrical currents. So thoroughly did he apply himself to the development of radio communication that he was elected president of the Commission Internationale de Télégraphie sans Fils in 1914, whose investigations were soon interrupted by the great war.

Rollin J. Makibbin, of Green Park, Pa., general manager of the Perry County Telephone & Telegraph Company, has presented a high grade camera, with two exceptionally fast lenses, to the United States government in answer to its plea for donations of this kind for use of the Navy.

Walter Thorgrimson, district commercial manager of the Lincoln district of the Lincoln, Nebraska, Telephone & Telegraph Company, will have jurisdiction of the Lincoln office, with R. C. Parsons, chief clerk, in direct charge.

J. L. Marwilsky, for over six years associated with the construction, supply and equipment departments of the Gulf States Telephone Company, has been promoted to manager of the Groesbeck, Texas, exchange.

James Harrell, former district chief of the Cumberland Telephone & Telegraph Company, Puducah, Ky., has been commissioned second lieutenant following his training course at Fort Benjamin Harrison.

George W. Fawell, manager of the Lincoln exchange of the Lincoln, Nebraska, Telephone & Telegraph Company, has been transferred at his own request into the office of the commercial superintendent.

H. Blair Smith, formerly of Nashville, Tennessee, and now general auditor of the American Telephone & Telegraph Company, has been appointed to the important position of comptroller of that concern during the six months' absence of Charles G. DuBois, present holder of the office. Mr. DuBois having been loaned to the American Red Cross to systematize its accounting department for that length of time.

Superintendent Gantzmeyer, who has had charge of the Nebraska Telephone Company exchange at Bridgeport for about seven months, has been busy checking up his affairs preparatory to leaving for Sidney where he will manage the company's exchange. His place will be filled by Charles Penn of Litchfield, Nebraska. The cause for the change in managers is the enlistment of the Sidney manager in the army. Mr. Gantzmeyer has been an accommodating and efficient manager and his friends will wish him good luck in Sidney.

Frank Builta, publicity manager of the Nebraska Telephone Company, has been appointed as state advertising manager of the war savings campaign. He will begin an extensive campaign in the near future. Much interest is being evinced by the public in the campaign, offers of assistance coming from officials of large organizations throughout the state.

Fred Miller, formerly manager for the Citizens Telephone Company at Savanna, Ill., is now located at Illipolis, Illinois, where he has the management of the exchange, and also of another nearby town.

Roy E. Crowe of Grand Ledge, Michigan, has been named as local manager of the Michigan State Telephone Company to succeed Joe Reese, who has not as yet been assigned to new territory.

W. W. Richie, for the past four years manager, has resigned his position with the Southwestern Bell Telephone Company at Little Rock, Ark., and his place is being filled by Phad Ray of Mansfield.

Mrs. Grace I. Mitchell, has purchased the Osceola Telephone Company of Osceola, Texas, from W. H. Burke, and will personally assume charge of the exchange.

John Cornforth Valentine, a resident of Effingham, Kansas, for the past forty years, died at his home there on December 18. Twenty-one years ago he founded the Northern Kansas Telephone Company at Effingham and owned it until his death. Mr. Valentine went to Kansas from Indiana in 1868 and lived for a few years in Leavenworth county before going to Atchison county. He is survived by his widow, a son, A. G. Valentine, of Effingham, and a daughter, Mrs. S. Stevenson of Colby, Kan.

William A. Geiger, 75 years old, former part owner of the teleprone company at Churubusco, Ind., and retired merchant, died of paralysis. He is survived by one daughter, Mrs. O. H. Downey, wife of the editor of the Churubusco *Truth*.

J. C. Hubacher, general manager of the Monarch Telephone Manufacturing Company, Fort Dodge, Iowa, has the sympathy of his many friends in the telephone field in the recent loss of his wife.

W. C. Ewing, for eight years manager of the Fairbury, Neb., exchange of the Lincoln Telephone & Telegraph Company, has resigned and removed to Otis, Col., to enter the real estate business. Miss Alma Lange is temporarily in charge.

W. M. Jones, adjuster for the Pacific Telephone & Telegraph Company, Sacramento, Cal., has been appointed manager for the company in the Auburn, Cal., territory.

Charles Robinson, of Onawa, Iowa, has been installed as manager for the New State Telephone Company, Anthon, Iowa.

E. Q. Powlison, president of the Wheatland Telephone Exchange, Wheatland, N. D., and postmaster of that village for 20 years, passed away recently.

Elisha Humphrey, president of the Home Telephone Company, Waverly, Ohio, and the Adams County Telephone Company, West Union, Ohio, passed away recently at his home in Omega at the age of 62 years.

C. M. Bergeson, owner and manager of the Gilbert Telephone Company, Gilbert, Iowa, has sold his telephone plant to Patterson & Dunn, Milo, Iowa, for a consideration of $3,500. Mr. Bergeson has purchased the telephone exchange at Moravia, Iowa, and has already assumed charge.

H. R. Aisthorpe, secretary and treasurer of the Home Telephone Company, Cairo, Ill., and cashier for the First Bank & Trust Company, Cairo, has been elected to the directorate.

Miss Edna Riedel, who has been operator of the telephone exchange at Nordheim, Texas, for some time, has been made manager, succeeding Mrs. Hugh Wood, who recently resigned.

J. P. Lahr, has been appointed manager of the Cedar Bluffs exchange of the Lincoln Telephone & Telegraph Company. He had previously been in the company's service at Weeping Water.

Roscoe C. Saunders, who has been manager and principal stockholder in the Manilla Telephone Company, Manilla, Iowa, for a number of years, recently disposed of his holdings to James Innes, of Sloan, Iowa, who takes possession January 1.

Lyle P. Young, for several years manager at Polk, Neb., for the Lincoln Telephone & Telegraph Company, has been transferred to York, to take the place of J. W. Ramey, killed recently in an automobile accident.

R. L. Wallace has been appointed manager of the Peoples Telephone Company, Cooledge, Texas.

Arthur Newland, owner of the Heltonville Telephone Exchange, Bedford, Ind., died recently of paralysis at the age of 60 years.

Fred Yates, wire chief for the Kansas Telephone Company of Ottawa, Kans., has been promoted to the position of local manager. Mr. Yates has been connected with the telephone business in Ottawa for many years. He began with the old Home company, becoming manager upon the resignation of U. S. Hannum. Upon the merger of the telephone systems in Ottawa into the Kansas Telephone Company, Mr. Yates became wire chief.

Roy C. Pratt. local manager for the Nebraska Telephone Company, McCook, Neb., for some time has been transferred to North Platte.

NEWS FROM THE FIELD

ILLINOIS

The Farmington Telephone Company has elected officers as follows: President and manager, Lin Dikeman; vice president, Irving Reynolds, and secretary-treasurer, A. A. Luckey.

INDIANA

At the annual meeting of the Farmers' Mutual Telephone Company at Columbia City the old officers were re-elected as follows: A. A. Bush, president; E. E. Rindfusz, vice-president; Clinton Wilcox, secretary; W. H. Carter, treasurer, and R. R. Scott, general manager.

The Whitley County Telephone Company held its annual meeting recently and re-elected the present officers and directors for the ensuing year. They are as follows: President, James Adams; F. F. Marches, vice-president, and Mrs. Wm. Magley, secretary-treasurer; directors, F. F. Morsches, Mrs. Mary S. Magley, James D. Adams, S. J. Peabody, John L. Myers, Robert A. Adams, A. H. Krieg, J. P. Raupfer and W. F. McNagny.

The Eel River Telephone Company has increased its capital stock from $40,000 to $80,000.

IOWA

The Brooklyn Telephone Company has elected the following directors for the com-

ing year: J. E. Talbott, Brownlie Graham, Walter Uhl and J. W. Frizzell. The company has voted to incorporate.

At the annual meeting of the North English Telephone Company the following officers and directors were elected: President, Frank Warner; vice-president, E. G. Brown; secretary, T. M. Thompson; treasurer, R. L. Dean; directors, E. O. Smith, W. A. Wiley, Hiram Miller, Joe Tast and Elmer Miller.

New officers and directors were recently elected by the What Cheer Telephone Company for the ensuing year. The officers are: President, Harold L. Beyer; vice-president, E. L. Gaines; secretary, G. L. Saunders; treasurer, C. W. H. Beyer. The officers also constitute the board of directors. W. L. Agee is manager of the company. A. E. Budlong, of Toledo, Iowa, former owner of the company, disposed of his interest last spring.

At the annual meeting of the Wilton Telephone Company the following officers and directors were elected for the ensuing year: President, Dr. A. R. Leith; vice-president, Fred Maurer; secretary, H. E. Nicolaus; treasurer and manager, W. D. Harris; directors, W. D. Harris, H. E. Nicolaus, J. H. Wasker, Fred Maurer, George Bannick, C. H. Wilson, A. R. Leith, H. P. Mason and D. E. Smith.

MICHIGAN

The stockholders of the Shiawassee Mutual Telephone Company have elected the following officers: President, Norman Blake; vice-president, William Keller; secretary, Lucine Scribner; treasurer, Milton Davis. A meeting will be held the second week in January and a committee elected to hire help to take charge of the office and board of the company.

The Pinconning Mutual Telephone Company has increased its capital stock from $1,000 to $2,500.

H. Goodspeed was elected treasurer of the Citizens Telephone Company, succeeding John B. Martin. The other officers were re-elected as follows: R. D. Graham, president; Victor M. Tuthill, vice-president; A. E. Wells, secretary, and C. E. Tarte, general manager. The executive committee is composed of R. D. Graham, Victor M. Tuthill, John B. Martin and T. H. Goodspeed.

MISSOURI

The Tina Mutual Telephone Company held its first election since it being incorporated on December 17. The directors are: James Balker, J. P. Shield, Frank Yehle, Ed. Connor, Hardin Snider, W. P. Stout and Anthony Key.

The stockholders of the Home Mutual Telephone Company of Caldwell county met recently and elected directors for the coming year as follows: Judge Howard, R. L. Terry, J. N. Gittinger, H. S. Knoch, Jesse Ream, James McBride, E. P. Writt, Elie Penney and Clarence Bacon.

NEBRASKA

The Liberty Telephone Company held its annual meeting recently and elected the following officers for the ensuing year: President, Hazel Shannon; vice-president, W. C. Huntington; secretary, D. Douglas, and treasurer, C. S. Dalton.

OHIO

The Cambridge Home Telephone Company has increased its capital stock from $75,000 to $100,000.

At the annual stockholders meeting of the Citizens' Telephone Company at Circleville the following directors were elected: Edward E. Smith, W. S. Carpenter, H. P. Folsom, G. A. Schleyer, Miss Mary Schleyer, Fred R. Nicholas and Germain Joseph. The board of directors was organized by the election of the following officers: Edward E. Smith, president; H. P. Folsom, vice-president; Germain Joseph, secretary, and G. A. Schleyer, treasurer, H. M. Rounce is general manager of the company

A change has been made whereby C. W. Smith who has been manager of the Belle Center and Roundhead Exchanges for the United Telephone Company, has been transferred to West Liberty where he will have charge of the plant at that place. His position will be taken by Ray Pierson, who has been employed as linesman for some time.

OREGON

The Nevada, California and Oregon Telephone and Telegraph Company has been authorized by State Corporation Commissioner Schulderman to operate in Oregon. It is a Nevada corporation capitalied at $300,000. The officers are: President, Scott Hendricks, San Francisco; vice-president A. A. Rosenshine, San Francisco; secretary, W. E. Hills, San Francisco; general manager, A. J. Mathews, and director, Jules Alexander, both of Susanille, California.

SOUTH DAKOTA

At a meeting held at Winner the Ideal Mutual Telephone Company was organized and the following officers were elected: W. W. Lenker, president; L. F. Heller, vice-president; C. H. Flint, secretary; and A. G. Ivers, treasurer. Nels Anderson, W. C. Balfany and Frank Frank were elected as a board of directors.

WASHINGTON

A telephone line has been built from Colville 10 miles out to serve the farmers on Narcisse creek.

INCORPORATIONS

Goldsborough Telephone Company, Shelton, Wash., $1,500; Richard M. M. Haydon, John Liegal and Hattie Morgan.

Articles of incorporation have been filed by the Kahlotus & Page Telephone Company at Kahlotus, Wash., with $2,500 capital stock. The incorporators are John Steele, R. J. Cildeland and E. C. Kline.

The Riley-Harness Telephone Company at Sprangle, Wash., has been incorporated with $250 capital stock by John Emhoff, W. P. Tolle and W. E. Blevins.

The Taylors Telephone Company at Taylors, South Carolina, has been incorporated by W. Y. McDaniel, J. F. Freeman, C. C. Hammet and others.

Articles of incorporation have been filed by the Farmers & Merchants Telephone Company at Corsica, South Dakota, with a capital stock of $20,000. The incorporators are Ada Kuiper and Jas. Beukelman, of Corsica, and Frank Barrett of Armour.

The Burr Oak Telephone Company at Virgil, South Dakota, has been incorporated with $450 capital stock by George Eholdt, John Wullweber and A. B. Harris, of Virgil.

The Pioneer Independent Telephone Company at Zeal, South Dakota, has been incorporated with $15,000 capital stock by R. E. Davis, of Faith, and G. W. Shepard and A. B. Altfillisch of Zeal, South Dakota.

The Flat Creek Mutual Telephone Company at Flat Creek, Tenn., has been incorporated with $7,000 capital stock to operate telephone lines between Flat Creek and Shelbyville and other places. The incorporators are J. C. Tune, J. J. Hix, R. S. Hudson, J. P. Cromler, J. M. Gammil and B. D. Kingree.

The Port Arthur Telephone Company of Port Arthur, Texas, capital stock, $100,000; incorporators, P. K. Higgins of Liberty, Mo., and R. S. Shipley and J. W. Williams of Port Arthur.

The Seymour-Shiocton Telephone Company at Seymour, Wis., has filed articles of incorporation with $100,000 capital stock. The incorporators are Wm. Wallen and Henry M. Kimberly, of Oshkosh, and C. J. Jackson, of Seymour.

The Summersville Telephone Company has been chartered with $5,000 capital stock to operate a telephone business in Nicholas county, W. Virginia. The incorporator are Jos. F. Seibert, of Enon; Geo. A. Reader, of Gilboa; John W. Murphy, of Summersville; M. R. Groves, of Deepwell, and R. W. Sawyers, of Canvas, W. Virginia.

The Muscoda Telephone Company, Muscoda, Wisconsin, has been incorporated with a capital of $10,000; incorporators, A. W. James, Elizabeth James and J. M. Kaiser.

The New Boston Telephone Company, New Boston, Illinois, capital $10,000; incorporators, Luther J. Gorusch, George M. Akers, Florence D. Gorusch.

The Woodland Telephone Company of Woodland, Iroquois county, Illinois, filed a petition with the state public utilities commission asking for authority to issue first mortgage bonds to the amount of $3,500.

The Putnam County Telephone Company, Ottawa, Ohio, $1,000 to $100,000.

Articles of incorporation have been filed by the Saybrook Telephone Company at Saybrook, Illinois, with $16,000 capital stock. The incorporators are J. A. Brown, S. A. Brown and Rex Brown.

The Ringgold County Mutual Telephone Company at Mount Ayr, Iowa, has been incorporated with $500 capital stock. Its directors and officers are as follows: J. W. Sheil, R. C. Holden, E. P. Johnson, John Irving, J. S. Buck, directors; G. D. Moffatt, president; R. M. Buck, vice-president; A. L. Stephens, secretary; Charles Robinson, treasurer.

The Brevort Telephone Company at St. Ignace, Mich., has been incorporated with $2,000 capital stock by John Kolarski, Philip Mulvehill and Geo. A. Litehard, all of St. Ignace.

The Ashe Telephone Company at Jefferson, North Carolina, has been incorporated with $25,000 capital stock by L. L. Perkins, Ensa Perkins and W. R. Baugess.

The Dogden Farmers Co-operative Telephone Company at Dogden, North Dakota, has been incorporated with a capital stock of $2,500. The incorporators are: John Schimke, Knute Norberg, John Eisenreich, Henry Bohnet, George Norberg, Dan Anderson and Charles G. Norberg.

The Deavertown Telephone Company of Deavertown, Ohio, has been incorporated with $2,500 capital stock by J. B. Rhodes, M. E. Rhodes, J. O. Wainwright, C. H. Tom and Ralph Paul, all of Zanesville.

Articles of incorporation have been filed by the Star Telephone Company at Sand Springs, Oklahoma, with a capital stock of $20,000. The incorporators are H. A. Davis and H. J. Davis, of Sand Springs, and B. C. Connor, of Tulsa.

Articles of incorporation have been filed by the Wyoming Telephone Company at Pineville, South Carolina, with $10,000 capital stock. The incorporators are Guy White, H. W. Whitehead, James Damron, Blake Taylor and Thomas Hatfield, all of Williamston.